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AT&T plans big cut in rates for T-1 access

BY BOB WALLACE

Basking Ridge, N.J.

AT&T last week asked the Federal Communications Commission for approval to reduce T-1 access rates by an average of 11%.

The new rates will mean even bigger savings of up to 15% for some AT&T-provided T-1 access links, although a small number of customers will pay slightly more. Dedicated access can account for as much as half the price of an end-to-end private line.

"We expect customers who buy their own [T-1] access to take a long look at these [rates]," said Hemant Vaidya, division manager for AT&T's Accunet dedicated services.

The proposed rates will apply to Accunet T1.5 local access channels used to connect to AT&T's switched and dedicated data services, as well as Megacom, Megacom 800 and Software-Defined Network. They will take effect Oct. 11, pending FCC approval.

The cuts result from recent reductions in the fees local carriers charge AT&T for T-1 access and can result in substantial savings for users.

For example, the price AT&T charges for a three- to five-mile T-1 access link in New York would drop from $703.09 a month to $597.86 a month, or a 15% reduction. The same holds true for access links in most other cities (see graphic).

"We're very interested in the [proposed] rates because we have three sites that are using AT&T T-1s and would save money," said Donn Greiner, a telecommunications analyst with USAA Information Services, the network service unit of San Antonio-based United Service Automobile Association. "And we have a site with

See T-1 access, *page 69*

AT&T to cut T-1 access rates

Examples of how change will affect cost of 3- to 5-mile access link:

City	Current	Proposed	Percentage change
New York	$703.09	$597.86	-15.0
Chicago	$545.67	$472.77	-13.3
Dallas	$522.51	$461.63	-11.6
Atlanta	$554.08	$495.56	-10.5

Rates pending FCC approval.

GRAPHIC BY SUSAN J. CHAMPENY SOURCE: AT&T, BASKING RIDGE, N.J.

FCC carves up the airwaves for PCS

Carrier bands

Frequencies that carriers will bid on to offer voice, data and video services include:

- Two 30-MHz channels in each of 51 regional areas.
- One 20-MHz channel in each of 492 metropolitan areas.
- Four 10-MHz channels in each of 492 metropolitan areas.

User bands

The 40-MHz user bands are unlicensed and will allow users to operate voice and data PCS equipment – including wireless LANs, PBXs, telephones and hand-held data devices – without charge.

SOURCE: FCC, WASHINGTON, D.C.

FCC divides U.S. for new wireless providers

Spectrum plan creates web of service realms.

BY ELLEN MESSMER

Washington, D.C.

The Federal Communications Commission last week allocated radio spectrum for emerging personal communications services (PCS), setting the stage for a new generation of wireless voice, data and video offerings.

But the FCC's decision, which chops the country into hundreds of service areas, means it will be difficult to build nationwide PCS networks because would-be providers will have to aggregate spectrum in about 50 areas.

The lack of at least one nationwide PCS license drew criticism from Commissioner Andrew Barrett, who voted against the decision. "I wanted a service that could compete against existing players and perhaps provide some competition to the local exchange carriers," he said. "The decision today does a great deal to undermine that."

The congressional mandate to auction off scarce radio frequencies drove the FCC away from its original plan to have nationwide PCS licenses, FCC sources said. Auctioning off more individual licenses will mean more money for the U.S. Department of the Treasury, which expects to raise about $10 billion. Blocks of spectrum will be sold as 10-year licenses.

SLICING IT UP

The FCC split the available frequencies in the 1850-MHz to 2210-MHz band into 30-MHz, 20-MHz and 10-MHz channels to be auctioned off in 51 re-

See FCC, *page 69*

DISASTER RECOVERY

Frame relay users deal with outage headaches

BY BOB WALLACE

Although it's often a less expensive way to build a meshed network than using leased lines, frame relay has an Achilles' heel — disaster recovery.

In many cases, when an access link to a carrier frame relay port is lost, the user cannot reestablish a connection to that same port. That's a problem because incoming data is addressed to that port, and even if an alternate link is established for outbound data, incoming traffic cannot get through.

"We love frame relay, and we wouldn't go back to private lines, but this is a major problem that hasn't been addressed," said Jim Fay, manager of strategic technology with PMI Mortgage Insurance Co., a mortgage insurance sales firm in San Francisco.

"It's a universal issue for companies that use frame relay," agreed Chris Finn, senior analyst with TeleChoice, Inc., a Montclair, N.J., consultancy. "Frame relay networks are inherently redundant, but access to them is not."

See Frame relay, *page 69*

Novell's Unix plan draws 'friendly' fire

BY CARYN GILLOOLY AND CHRISTINE BURNS

New York

What was meant as an act of peace touched off a war last week as Novell, Inc. mapped out plans to unify the long-disparate Unix market and tie Unix more closely to NetWare.

Analysts said the broad-reaching Unix strategy is an attempt by Novell to counter interest in Microsoft Corp.'s Windows NT Advanced Server, which is being positioned as an application server.

To pique interest in UnixWare, a version of Unix, Novell plans to align it more closely with NetWare and, by the fourth quarter, begin licensing it rather than the Unix System Laboratories, Inc.'s (USL) SVR4 kernel to Unix licensees.

Many of the vendors selling Unix license the Unix kernel from USL, which Novell acquired last June.

If vendors adopt the common UnixWare core — which would be more robust than the SVR4 kernel — applications written for one version would be able to run over other UnixWare-based versions. Today, vendors significantly alter the SVR4 product, rendering different versions inoperable.

See Unix plan, *page 68*

IBM, HP pitch plan for fast token ring

BY SKIP MACASKILL

Palo Alto, Calif.

Hewlett-Packard Co. and IBM this week are expected to propose the first standard for a 100M bit/sec token-ring network — a move that would boost token-ring capacity by six to 25 times and help support new multimedia and downsized business applications.

The 100VG-AnyLAN technology is an extension of HP's 100Base-VG standard for 100M bit/sec Ethernet. It offers users of 4M and 16M bit/sec token-ring local-area networks a migration path to high-speed networking, while preserving existing investments in network operating systems, applications and cabling.

"100Base-VG has become 100VG-AnyLAN," said Brice Clark, strategic network planner at HP.

Fast LAN options

FDDI
100M bit/sec token-passing network

Copper Distributed Data Interface
FDDI-over-copper cabling

Fast Ethernet
100M bit/sec version of venerable LAN

Fast token ring
100M bit/sec version of token ring

Asynchronous Transfer Mode
Cell-passing net supporting speeds of 50M bit/sec and higher

Despite the benefits promised by 100VG-AnyLAN — increased bandwidth, higher performance and support for multimedia applications — users offered mixed reactions.

"100M bit/sec over unshielded twisted pair is not field-proven, and we would not be willing to try it out in a network as mission critical as ours," said James Harrington, director of wide-area network engineering for the Social Security Administration's office of telecommunications in Baltimore. "If we used it, we'd feel like we were cutting corners, and we can't afford [that]."

But John McGinnes, manager of MIS for Kankakee, Ill.-based Henkel Corp.'s Functional Products Group, said, "Anything we can have that will increase network speed and let us take advantage

See Pitch, *page 68*

NEWSPAPER
100

Are You Ready?

It's a jungle out there. And your people are demanding bigger, faster and more diverse services. Like E-mail, video conferencing. LAN interconnection and high-speed data transmission. This means your network is growing in size and complexity. That's why you should call on your local phone company. Your phone company is backed by the products and services of AT&T and AT&T Bell Laboratories. That makes it easier for them to give you the quality and reliability you need. So it'll be easier for you to get your service up. To get all your people hooked up. And to keep your network up. Plus, your phone company can provide all the bandwidth you demand, on demand. So call your local phone company. Because it could mean the difference between data networking and data not working.

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Recent events suggest the administrative burdens of your network could grow substantially.

Briefs

AT&T wants new rules. AT&T last week asked the Federal Communications Commission to end its categorization as a dominant carrier so it can operate under the same regulatory conditions as other long-distance carriers. AT&T also asked the FCC to implement new rules governing foreign long-distance carriers that do business in the U.S. AT&T said the rules should address issues such as whether a foreign carrier should be allowed to operate in the U.S. if that carrier's home market is closed to competition.

Congress backs FTS-2000. The House and Senate last week agreed on legislation that would continue the mandatory use of FTS-2000 by federal agencies, with the provision that the General Services Administration report to Congress by July 31, 1994 that the FTS-2000 program has been found to be cost-effective.

IBM, Sybase go multimedia. IBM and Sybase, Inc. have announced a joint initiative to expand the multimedia offerings for IBM RISC System/6000 workstations. Under the first phase of the initiative, the companies will bundle a suite of interactive multimedia demo applications built with Sybase's recently announced multiuser, object-oriented Gain Momentum software. The applications, which work with IBM AIX Ultimedia Services/6000, are examples of business applications designed to show the capability of multimedia on the RS/6000.

Amdahl gets some Sun. Sun Microsystems, Inc. and Amdahl Corp. will team up to deliver software that will help integrate large mainframe environments with Unix-based client/server networks. Under the agreement, the two companies will produce a set of products that tie together applications running on Amdahl's UTS system, which is a commercial Unix operating system for mission-critical mainframe applications, and Sun's Solaris Unix operating system. Products addressing security, on-line information management and distributed system management are scheduled to ship in the second quarter of next year.

Schizophrenic. Digital Equipment Corp. last week unveiled Dorio, a single-session text terminal that can emulate 16 different types of terminals, allowing it to work with more than 30 host operating systems, including Unix, multiuser DOS and OpenMVS. Dorio terminals are available immediately for $399.

3270 for less. NetSoft last week announced 3270 emulation software for Windows and Windows NT users that sells for $95, far less than the $300 to $500 commanded by competing Windows 3270 emulators. NetSoft's NS/3270 supports two host sessions, file transfer, keyboard remapping and Novell's NetWare for SAA host gateway. NS/3270 will come in two versions: a 16-bit Windows version available Oct. 15, and a 32-bit Windows NT version available Nov. 15.

Novell, Compaq get closer. Novell, Inc. and Compaq Computer Corp. last week entered into an Enterprise Computing Partnership under which both companies will participate in joint marketing and sales programs, work together to design integrated hardware and software platforms, develop network testing standards and procedures, and extend their service and support programs. The deal extends an existing OEM and joint development relationship between the two companies.

Giving it away. Microsoft Corp. last week revamped the pricing structure for Windows NT Advance Server and LAN Manager so that when users buy the server software, they get client software at no additional cost.

Contacts

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Network HELP desk

Network World *tracks down answers to your questions regarding products, services, technologies or disputes with vendors. Please submit questions to Susan Collins, associate features editor, at (800) 622-1108, via fax at (508) 820-3467 or via the Internet at scollins@world.std.com.*

My company has a 4M bit/sec token-ring local-area network running Novell, Inc.'s NetWare 3.11. Currently, the speed at which applications load from the server and databases perform is slow. Is there a way to fine-tune the network, or should we upgrade to 16M bit/sec?

Robin Fitzgerald, Palmer, Mass.

John Hetrick, a project engineer at Computer-Land Corp., a computer reseller, network integrator and services provider in Pleasanton, Calif., replies:

There are other indicators to look for before increasing the speed of the ring. Many factors will affect the speed at which applications load and databases perform.

First, consider increasing server random-access memory. This will allow the network operating system (NOS) to cache more files and data into RAM for faster access as opposed to slower disk I/O. This is particularly important for databases that are read/write-intensive.

For NetWare, the formula to determine the minimum amount of RAM needed is: (.023 x volume size)/block size (default is 4) for each volume (VOL@ + VOL2 ...) + 2M bytes = minimum memory requirements.

In general, 16 to 32M bytes provides the best performance, although this may change depending on the applications and other services that may be running on the server, as well as the amount of disk space dictated in the formula above.

If possible (depending on your NOS), align the file allocation block size of the hard drive with the record size of your database. Since databases can have large record sizes, expanding the block size to match the file/record length allows data to be moved with fewer disk reads/writes, thus reducing overhead on the NOS and improving performance.

Also consider your token-ring design. One or more of the following options may work in your

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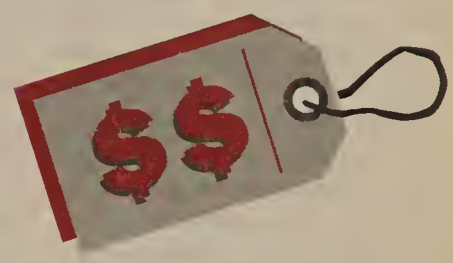

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Cisco buys Crescendo, plunges into work group switching mart

Company pays $90 million for Crescendo acquisition, putting new hub technology within arm's reach.

BY MAUREEN MOLLOY

Menlo Park, Calif.

Cisco Systems, Inc. last week agreed to shell out about $90 million to acquire Crescendo Communications, Inc. — a move that gives the market-leading router vendor access to new hub and high-speed LAN technology, as well as fast Ethernet and ATM switching capabilities down the road.

SCOTT MCKIERMAN

MORGRIDGE

Crescendo's current product line includes a 16-port work group hub that supports both Fiber Distributed Data Interface and Copper Distributed Data Interface (CDDI), which is the name the Sunnyvale, Calif.-based vendor has given to its FDDI-over-copper technology.

The hub conforms to the ANSI X3T9.5 standard for running FDDI traffic over shielded and unshielded twisted-pair wiring, and does not currently support switching. Crescendo also markets workstation adapters as well as management software to monitor and control the products.

ATTRACTIVE FUTURE

Cisco was also attracted to Crescendo's high-speed local-area network switching expertise. John Morgridge, Cisco's president and chief executive officer, and Mario Mazzola, Crescendo president and cofounder, confirmed that Crescendo has been actively developing fast Ethernet and Asynchronous Transfer Mode switching products that will become available as early as mid-1994. Both, however, declined to provide details about the products.

Cisco was also cagey on how it plans to meld Crescendo's offerings into its product line. Cisco officials said the firm acquired Crescendo primarily for its CDDI and application-specific integrated circuit technology, which will enable the company to develop network switching products. All products will fall under the same management umbrella as Cisco's existing router line.

Cisco user Ron Zelman, technical services manager at City of Hope National Medical Center in Duarte, Calif., said a fast Ethernet switching hub will be welcome to support the growing spate of Unix workstations in his network. Local ATM switching will also be a requirement in about four years.

"We're starting to get heavily involved in imaging, particularly in radiology, so we expect to need fast Ethernet switching hubs within the next year or two," he said.

According to Morgridge, high-speed work group switching is the fourth key market his company had planned to enter. Cisco already commands the lead in the campus and wide-area internetworking market, and more recently began targeting the IBM Systems Network Architecture internetworking and emerging low-end access routing markets.

Cisco has expanded its technology portfolio in the past by hiring the talent it needs or, on rarer occasions, by partnering with another vendor. The outright buyout of Crescendo will help Cisco get into the local switching market faster, Morgridge said.

AN EARLY MOVE

Crescendo's Mazzola, who will now serve as the vice president and general manager of Cisco's newly formed High Performance Workgroup business unit, agreed. "Our mission from the start has been to address high-performance work group networking. By being brought under the Cisco umbrella, we're now in a position to address that more strongly and more quickly than we could have on our own," he said.

According to analysts, Cisco is making an early play for a significant share of what is expected to be a high-growth and lucrative networking technology. "Cisco realizes that this niche will become significant and they can become a major player by marrying its routing expertise with Crescendo's local hubbing and switching technologies," said George Kelly, a principal at Morgan Stanley & Company, Inc. in New York.

David Passmore, vice president and service director at Gartner Group, Inc. in Stamford, Conn., said the acquisition illustrates the growing rivalry between router and hub vendors as both increasingly aim for similar roles in users' networks.

"Routing and hubbing are technologies that complement each other, but soon the line between what's a router and what's a hub will begin to blur," Passmore said. "In order to compete effectively, Cisco needs to have a bigger presence in the local hub and ATM markets, and Crescendo is a good way for them to get that."

Todd Dagres, vice president of data communications at The Yankee Group, a Boston-based consultancy, agreed. "Cisco needed LAN switching technology, and this deal looks beyond Crescendo's existing line to tomorrow's products," he said. "The value is not in what they can sell today, but what they'll have three years down the road."

THE ACQUISITION

Cisco said the Crescendo acquisition is radically different from an earlier plan to integrate routing and hubbing into a single device. The vendor last spring scrapped plans to develop a so-called RubSystem, which would have integrated Cisco's high-end routing capabilities into SynOptics Communications, Inc.'s next-generation hub.

The buyout plan

Cisco Systems, Inc., which dominates the router market, is buying **Crescendo Communications, Inc.**, a supplier of FDDI-over-copper and hub products, in a deal valued at roughly $90 million. Cisco will assume all of Crescendo's employee stock options and warrants in a swap for 2 million shares of Cisco stock.

The RubSystem effort was an attempt to take two full-scale systems and merge them together, making it difficult to bring it to market on time and provide seamless upgrade support. On the other hand, with the Crescendo acquisition, Cisco is using Crescendo's technology as the basis to extend its Ethernet, FDDI and ATM offerings. The latest deal also gives Cisco sole ownership of the technology.

Comments

If you have a comment on this or any other article, drop us a fax at (508) 820-3467 or call (800) 622-1108, Ext. 487.

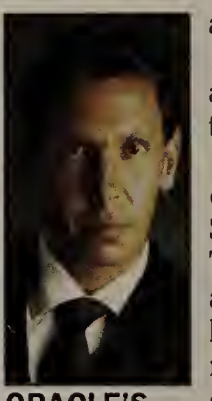
Oracle and its rivals ready updated DBMSs

BY PETER LISKER

Orlando, Fla.

Oracle Corp. will unveil here today Release 7.1 of the Oracle7 relational database management system (DBMS), which includes two technologies said to be key to the continuing acceptance of distributed processing.

The company will detail for some 6,000 users attending this week's International Oracle Users Group meeting its new Parallel Query Option (PQO) and Enhanced Data Replication technologies.



ORACLE'S ELLISON

PQO automatically decomposes SQL queries into operations that can be simultaneously executed across parallel processors in a single machine. The process is transparent to users and programmers, and begins to resolve one of the problems of parallel processing: how to automatically split tasks between processors without requiring custom programming. Oracle is expected to present dramatic price/performance arguments, backed by test results demonstrating decreased processing times for complex queries.

In addition, parallel queries coupled with parallel systems will enable customers to do decision support queries on massive amounts of data. The company will cite one example where a report that formerly took hours to run is now running in approximately two minutes.

"PQO will be a very big deal for the industry," said Peter Kastner, vice president of corporate computing for Aberdeen Group, Inc., a Boston consulting firm.

Other database vendors are close to announcing similar technology, the arrival of which will likely spark debate about the "correct" mechanism for implementing parallelism.

Informix Software, Inc., which for two and a half years has been jointly developing parallel processing software with Sequent Computer Systems, Inc. in Portland, Ore., has code in alpha stage and expects to release in the first quarter of 1994 a parallel processing version of its relational DBMS for Sequent computers.

Versions for other machines, including those from Hewlett-Packard Co. and IBM, are expected to be available in the second half of 1994. Informix will formally announce its product plans at the end of November.

Sybase, Inc.'s parallel processing entry, the Navigation Server, will debut in January. The product is currently in alpha test. Selected customers have the code and are beginning the process of building databases and applications. Sybase expects the product to enter beta in the first quarter of 1994 and hopes to ship production code by the second half of 1994.

The other technology, Enhanced Data Replication, is an upgrade of Oracle's approach to synchronizing data in a distributed environment.

Oracle7, includes the distributed option that combines two-phase commit and replication technologies in a single architecture, letting customers use either technique to ensure data concurrency when distributing databases throughout a net.

Enhanced Data Replication goes beyond last year's offering by allowing database administrators to replicate data from multiple sources, rather than from the single master source of prior Oracle offerings. This means that updates at any site within a distributed system are reflected at all other sites automatically.

Unify Vision shines at show

BY PETER LISKER

New York

At Unix Expo here last week, Unify Corp. unveiled Unify Vision, a graphical, object-based tool for cross-platform application development.

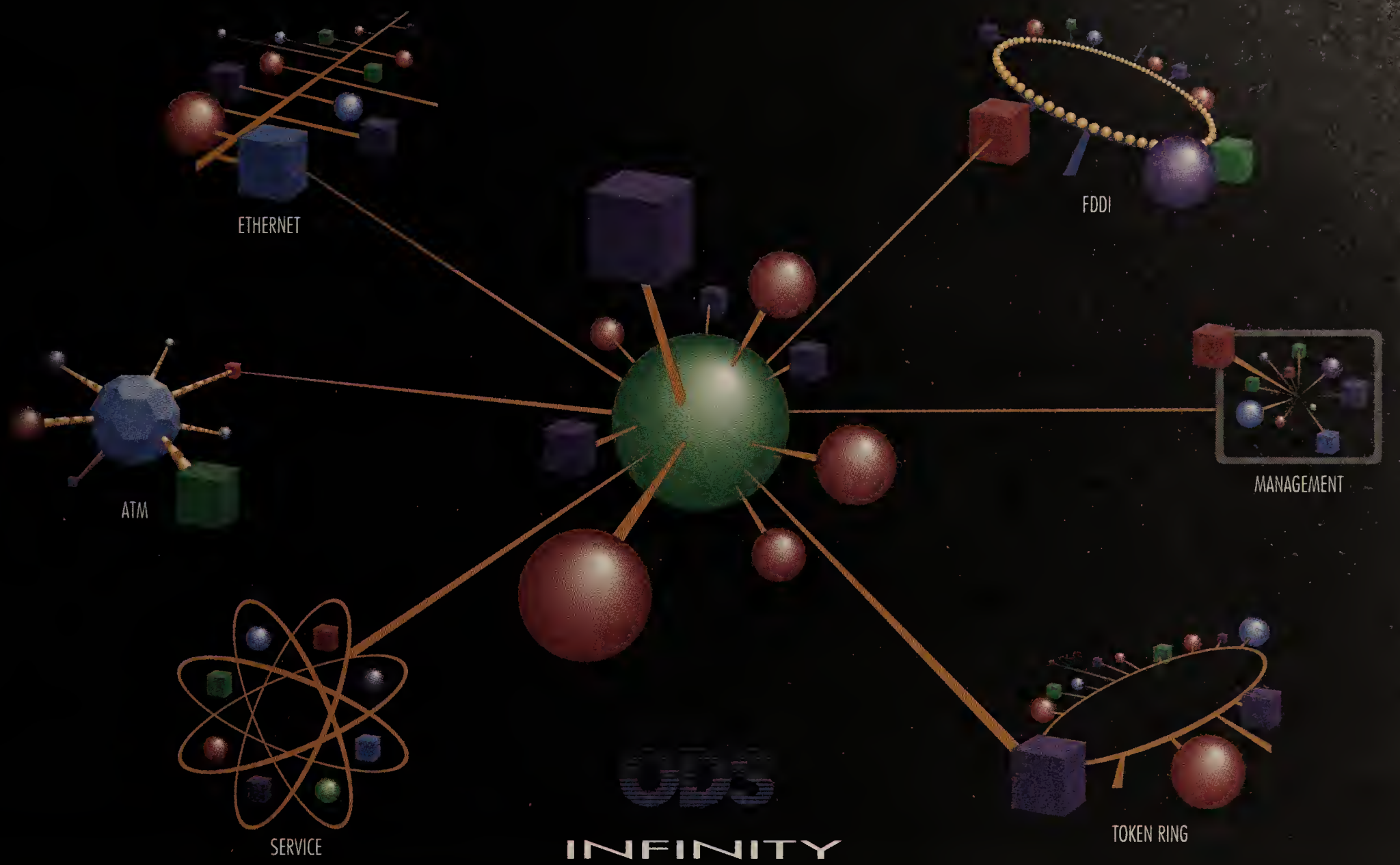
Unify Vision incorporates an intuitive user interface called SmartView that helps developers create applications without concern for the intricacies of how the program should access the target database. Also, the system supports the development of applications that can simultaneously access multiple heterogeneous databases.

"The current batch of client/server tools don't really meet the expectations of programmers because they don't support an open environment," said Reza Mikailli, senior vice president of products at the Sacramento, Calif.-based Unify. "Unify Vision is part of a comprehensive family of tools that automates the application development process for everything from small departmental to large enterprise, mission-critical applications."

Unify Vision will initially be available for Sun Microsystems, z Inc. SPARCstations and SPARCservers, Hewlett-Packard Co. HP 9000 and IBM RISC System/6000 workstations running Unix, Motif or Open Look and personal computers running Windows. Databases supported include Unify's Unify 2000 and others from companies such as Oracle Corp., Sybase, Inc., Informix Software, Inc. and Ingres.

Unify Vision prices range from $1,495 for single-user development licenses to $3,995 for the enterpisewide version. It's now in beta, with general availability scheduled for November.

Unify: (800) 248-6439.



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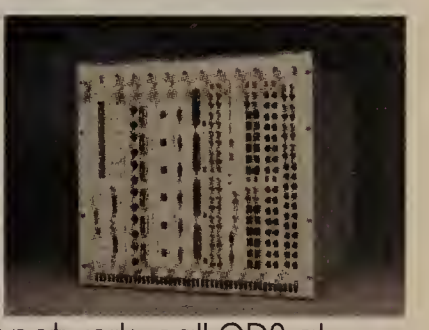

COMMUNICATIONSWEEK MIXED-LAN MAX AWARD

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Lotus details strategy for messaging products

Promises raft of products at cc:Mail user meet.

BY BOB BROWN

San Francisco

Lotus Development Corp. last week cleared the air surrounding its messaging products when it detailed a strategic plan that includes delivery of a cross-platform messaging server supporting cc:Mail and Notes users.

The plan offers cc:Mail and Notes users the option of migrating to a common mail back end that works with existing client software, and the promise of more robust clients now under development.

The new Lotus Communications Server (LCS), which will support 1988 X.400 and the Simple Mail Transfer Protocol natively, is key to Lotus' plan to position itself as a provider of scalable messaging systems. Lotus will roll out other new products and enhancements to existing products during the next 12 to 18 months to fulfill its strategic vision, said Larry Crume, vice president of electronic messaging at Lotus.

The strategy statement said Lotus will support and enhance the file-sharing version of cc:Mail even as it develops a new version designed to work with the Notes message store and LCS, which will be based on the client/server architecture of Lotus' Notes groupware server.

In a file-sharing electronic mail system, clients nandle the bulk of message processing, compared to a client/server system where desktops and servers share responsibilities. Developing a coordinated messaging strategy has generated much discussion and dissension at Lotus, which has lost many key cc:Mail employees since acquiring cc:Mail, Inc. in 1991 (*NW*, Sept. 8, page 1). Lotus unveiled its plan here at InterChange '93, an annual cc:Mail user conference that attracted about 1,200 attendees this year. There are more than 3 million cc:Mail end users.

Users reacted positively to the news, although they were disappointed Lotus had fallen behind in development of a new cc:Mail post office called Sequoia and failed to give delivery dates or prices for future products.

"I like the strategy," said Pete Donaghy, manager of enterprisewide information systems at Hughes Electronics in Long Beach, Calif. "Lotus is looking to provide users with a good migration path from file sharing to true client/server, where security and management can become server-based processes."

A user at a federal government organization who asked not to be named also was encouraged by the Lotus statement of direction. Although the organization has not committed to Notes, the strategy "would allow a smooth upgrade from basic E-mail to Notes at any time," he said.

LCS would provide centralized routing, directory and administrative services for cc:Mail and Notes users. Cliff Conneighton, director of marketing at Lotus, said LCS will be a message backbone node robust enough to support mission-critical applications. It will support Lotus message products and gateways to other message systems.

LCS will run on multitasking operating systems — including OS/2, Windows NT, and versions of Unix from Hewlett-Packard Co., IBM and Sun Microsystems, Inc. — to ensure high performance. It will also be available as a Novell, Inc. NetWare Loadable Module and will run on multiple networks, including Transmission Control Protocol/Internet Protocol, Banyan Systems, Inc. VINES and X.25.

Eventually, LCS will support X.500 and the Simple Network Management Protocol, though few details were offered about this. Lotus declined to provide LCS pricing, but Crume said it should be in the range of existing Lotus message servers. Notes servers sell for $495, while cc:Mail Routers cost $1,295.

Lotus also plans to deliver a scaled-down version of LCS, called LCS/DOS, designed for users with only cc:Mail. LCS/DOS will combine cc:Mail's Router 4.X message transport system and Automated Directory Exchange product and will support new features. LCS/DOS will transfer messages between cc:Mail post offices, including Sequoia, and tie into LCS at sites moving to Notes. LCS/DOS will likely be one of the first products delivered under the strategy.

The Sequoia message stores (also called post offices), which initially were slated to roll out this year, will provide a slew of enhancements over existing cc:Mail message stores. Features will include hierarchical naming directories, administrator defined fields and the removal of limits, such as the number of attachments that can be included with a message.

Lotus said it will enhance existing clients to run with Sequoia while developing new clients that work with the Notes message store. The new clients will be upgradeable to Notes clients. All clients will have the same user interface and pricing.

Lotus promised to deliver next year a version of cc:Mail that works with Novell, Inc.'s Message Handling Service, dubbed cc:Mail MHS Edition, as well as versions for public mail services.

Lotus officials also hinted at a message-based forms routing product to include a graphical forms builder and be available early next year. It will work with mail products that support the Vendor Independent Messaging specification as well as Microsoft Corp.'s Messaging Application Programming Interface, and use Notes for storage.

David Ferris, editor of the "Ferris E-Mail Analyzer," a monthly newsletter based in San Francisco, said, "Lotus is focusing on things to make its offerings more scalable and manageable," but added that it needs to better articulate its management strategy to make users more comfortable about moving applications onto its messaging nets.

✆Lotus: (617) 577-8500.

Grab bag of Lotus products

- **Lotus Communications Server (LCS)** Message transfer server for cc:Mail and Notes.
- **cc:Mail Post Office Edition** Enhanced cc:Mail client that works with Sequoia message store.
- **Sequoia** Next version of the cc:Mail message store.
- **LCS/DOS** Combines cc:Mail message transfer server and directory exchange with new features.
- **cc:Mail Client/ Server Edition** New version of cc:Mail client that works with Notes Object Store and LCS.

Integrating message systems

Attachmate Corp. and WordPerfect Corp. announced at last week's InterChange '93 user group conference new tools for integrating messaging and scheduling systems.

Attachmate and Lotus Development Corp. have signed an agreement to develop a bidirectional link for exchanging group scheduling information between IBM's Professional Office System (PROFS) or OfficeVision/VM host-based office systems and Lotus' desktop Organizer product. WordPerfect has developed a gateway between its WordPerfect Office 4.0 and Lotus' cc:Mail that will let users of the two electronic mail systems exchange messages.

Under the Lotus-Attachmate agreement, Lotus will develop the Organizer Scheduling Connection to Attachmate's ZIP!Office server, an E-mail and group scheduling server. The connectivity software will let Organizer users directly view free and busy times of PROFS and OfficeVision/VM users to make appointments. No pricing was announced.

The soon-to-be-released WordPerfect Office cc:Mail Gateway, which will run on DOS, will let users of the two E-mail systems swap messages and synchronize their directories. Previously, WordPerfect Office users could only access cc:Mail users via an intermediary protocol, such as X.400 or Novell, Inc.'s Message Handling Service (MHS), said Karen Buckner, a product manager for WordPerfect. The gateway will let users on one E-mail system send messages to users on the other system who are employing a different address format.

The gateway will compensate for differences between WordPerfect Office and cc:Mail. For example, cc:Mail users are limited to sending 20 attachments per message, but WordPerfect Office users can send an unlimited amount. If a WordPerfect Office user sends a message with 60 attachments, the gateway breaks the message into three pieces before sending them to a cc:Mail user.

WordPerfect's strategy is to provide better connectivity for its users and utilities to help them migrate from cc:Mail to WordPerfect Office, Buckner said.

The WordPerfect Office cc:Mail Gateway will cost about $3,000.

Attachmate: (206) 644-4010; Lotus: (617) 577-8500; WordPerfect: (801) 225-5000.

BY BOB BROWN

SUPERSERVERS

Tricord boosts fault tolerance for Unix servers

BY CARYN GILLOOLY

Minneapolis

Tricord Systems, Inc. bolstered its product line last week with the introduction of fault tolerance capabilities for its superservers and new enterprise and work group servers, in addition to field upgrades for its existing servers.

Topping off the list, Tricord introduced Open Fault Tolerance (OFT) for Unix, which gives its PowerFrame superservers running Unix the fault tolerance capabilities provided in Novell, Inc.'s SFT III. Fault tolerance is a key asset to users running production applications in a local-area network environment.

Tricord was heavily involved in the implementation of Novell's SFT III, and many of its customers have implemented mirrored PowerFrame systems in NetWare environments. But there was no fault-tolerant product for customers running Unix-based PowerFrames, according to Sheldon Fossum, senior product marketing manager at Tricord, based here. "For many, downtime is just not acceptable," Fossum said.

An OFT for Unix customer must have two PowerFrames, each running a version of SCO Unix. By mirroring disks and actual processes across a high-speed, server-to-server link, OFT guarantees availability, even if the primary server fails completely.

OFT for Unix currently supports only SCO Unix, but Tricord is considering support for other Intel Corp. Unix implementations, such as Novell's UnixWare and SunSoft, Inc.'s Solaris.

OFT for Unix will be available by the end of the year, although pricing has not been set.

HARDWARE OFFERINGS

On the hardware side, Tricord introduced the PowerFrame Model 20, a server designed for work groups of 20 to 30 users.

In its base configuration, the PowerFrame Model 20 has one 66-MHz Intel i486DX2 microprocessor, 16M bytes of main memory, 425M bytes of disk storage and an eight-slot Extended Industry Standard Architecture bus. The Model 20 will optionally support a single Pentium processor, with support for dual Pentium processors planned for future upgrades.

The PowerFrame Model 20 is available now and is priced starting at $9,900.

On the high end, Tricord released the ES4000. The product is essentially a build-it-yourself version of its existing ES5000, offering the same capabilities but in modular form so users can add features as needed.

The ES4000 base configuration features one 66-MHz Intel i486DX2 microprocessor and is scalable to six 66-MHz Intel i486DX2 or Pentium microprocessors. Storage is scalable from 525M bytes to 488G bytes, and error-correcting memory is scalable from 64M bytes to 1G byte. The ES4000 will be available by year end and starts at $43,900.

Tricord is also offering upgrades to its existing PowerFrame Model 30 and Model 40 machines. The first of these is a CPU module that lets customers field-upgrade their machines to support Intel's Pentium processor. The company also brought out a new release of its Enhanced Intelligent I/O Processor that doubles the processor's clock speed and provides virtually double the I/O performance.

The upgrades will be available by the first quarter of 1994. Pricing has not been set.

Tricord last week added support for three more operating systems: Solaris 2.X, Unix System Laboratories, Inc.'s Unix SVR4.2 SMP and IBM's OS/2 SMP.

✆Tricord: (612) 557-9005.

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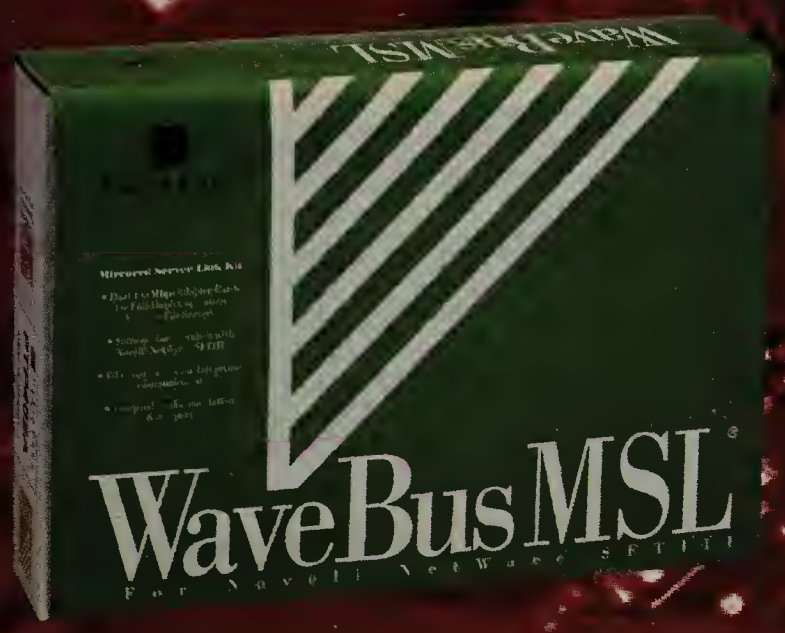

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RIDE WITH THE WINNER CATCH THE WAVE WITH PLAINTREE SYSTEMS

Carriers widen video access

BY BILL BURCH

San Diego

MCI Communications Corp. and Sprint Corp. last week announced a series of enhancements for their respective videoconferencing services, hoping to widen their appeal to small and midsize businesses.

Both companies rolled out the changes at the Tele-Communications Association, Inc. trade show here, where MCI also announced that it would use 800 access to its X.25 network to provide transaction processing services.

MCI led off the videoconferencing announcements with a series of connectivity enhancements to its VideoNet service, which was introduced in May.

MCI's network can now serve as a gateway to other carrriers' videoconferencing networks. For users that need international connectivity, MCI has added seven countries to the 11 nations to which it connects for switched 64K bit/sec service. These switched services are widely used for videoconferencing.

MCI also announced an alliance with Compression Labs, Inc. (CLI) that calls for CLI to supply turnkey videoconferencing systems that MCI's VideoNet customers can lease or purchase.

With the enhancements, MCI is hoping to build on existing momentum for videoconferencing. Declining equipment costs and broadening industry support for the H.320 videoconferencing standard, which allows different manufacturers' machines to interoperate, are already generating new interest, according to Paul Weichselbaum, the carrier's vice president of data

See **Carriers**, *page 68*

Cabletron to offer PC module

BY SKIP MACASKILL

Rochester, N.H.

Cabletron Systems, Inc. this week will roll out a personal computer module for its hub line that supports a variety of net services and server functions, including the ability to be configured as a Novell, Inc. NetWare server.

The Personal Computer Media Interface Module (PCMIM) is designed to help users simplify the integration of remote offices into corporate local-area networks because software-based routing and server functions can be loaded onto the module in the hub. PCMIM can also be used to provide file, print and mail services, as well as distributed net management funtionality through its analysis and management tools.

"PCMIM is much more than a server platform that runs NetWare," said Bill Clark, product manager of advanced technologies at Cabletron.

PCMIM, which takes up one slot in the company's Multi Media Access Center (MMAC) intelligent hub, is based on a 66-MHz Intel Corp. 80486DX processor and offers two additional Extended Industry Standard Architecture (EISA)expansion slots and two 209M-byte hard drives.

The module will offer backplane connections for both Ethernet and token-ring networks and come equipped with 8M bytes of random-access memory, which is expandable to 64M bytes.

The module, which comes preloaded with MS-DOS 6.0 and a Simple Network Management Protocol agent, is upgradable to support a Peripheral Component Interconnect bus as well as Intel's Pentium processor.

According to Mike Skubisz, director of product management at Cabletron, PCMIM will likely be used as a link between different networks. "We don't see the file server as being the dominant application for this product," he said. "PCMIM is well positioned to offer connectivity into different network realms such as [Asynchronous Transfer Mode] and wireless."

By plugging an ATM adapter card from Fore Systems, Inc. into one of PCMIM's EISA slots, for example, MMAC Ethernet and token-ring users could communicate with an ATM network while maintaining access to PCMIM applications.

By connecting the antenna of Cabletron's Free-Link Wireless LAN System to one of the PCMIM's EISA slots, users can also interact with resources on a wireless network.

PCMIM can simplify support of branch offices since the server and router functions can be integrated into a single hub platform, eliminating the need for three devices.

For example, since many branch sites do not have the technical expertise that is available in a centralized data center, the module can be preinstalled with NetWare and NetWare Loadable Modules for Novell's Multiprotocol Routing Plus software and NetWare Con- nect remote access server software, and shipped out to the remote office.

Cabletron's chief rival, SynOptics Communications, Inc., made a similar hub/server announcement with Novell at last month's INTEROP trade show. According to industry analysts, however, there are several differences between the two moves.

"Cabletron is positioning the PCMIM as a high-performance platform in the hub, while SynOptics is looking to create a more general-purpose communications server," said Todd Dagres, vice president of data communications at The Yankee Group, a consultancy in Boston. "Cabletron has put in a higher end server, which means it will be more expensive than the SynOptics module, but it's justifying that with greater memory, greater buffer and a higher clock speed."

Dagres said these platforms allow SynOptics and Cabletron to build routing into their hubs without help from the firms such as Cisco Systems, Inc. and Wellfleet Communications, Inc.

Available in December, PCMIM costs $6,995.

✆Cabletron: (603) 332-9400.

Are you being served?
How the integrated hub servers stack up.

Company	Cabletron Systems, Inc.	NetWorth, Inc.	Optical Data Systems, Inc.	SynOptics Communications, Inc.
Product	Personal Computer Media Interface Module	NetWare Application Engine	Connection Server	LattisEngine/486
CPU (MHz)	80486DX (66)	80486DX (33)	80386SX (20)	80486SX (33), expandable to 66
Base RAM (M bytes)	8	4	4	8
Expansion memory (M bytes)	64	32	64	128
Hard disk capacity (bytes)	418M (2 209M-byte drives)	120M	40M to 2G	120M
Expansion slots	2	2	2, 4 or 7	3
Hub slots required	1	2	1, 2 or 4 (3 models)	2
Bus type	EISA, ISA	ISA	ISA	ISA, PCI
Price	$6,995	$3,995-$4,995	$4,000-$4,500	$5,000-$8,000

EISA = Extended ISA
ISA = Industry Standard Architecture
PCI = Peripheral Component Interconnect

SOURCE: *NETWORK WORLD*
GRAPHIC BY SUSAN J. CHAMPENY

IBM increases mgmt. for Unix-based AIX

Offers cross-platform support, global directories.

BY CHRISTINE BURNS

New York

IBM last week introduced three advanced RISC-based servers along with an upgraded version of AIX that supports new or enhanced management software and an OSF DCE-compliant global directory service.

UNIX EXPO

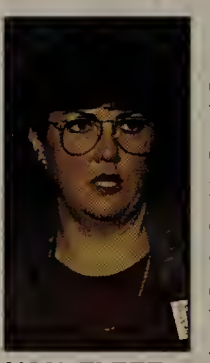
The management products — Visual Systems Manager and Distributed Systems Management Interface Tool (DSMIT)/6000 — let network administrators more easily control client machines and other devices on multivendor Unix networks.

IBM's new directory, based on the Open Software Foundation, Inc.'s Distributed Computing Environment standards, is an X.500 implementation that will help AIX users locate any DCE-compatible network resource.

JAROSH

The three new servers introduced at Unix Expo are the POWERserver990, POWERstation/ POWERserver 590 and POWERstation/POWERserver 58H. All three models include IBM's POWER2 microprocessor, which has twice the power of existing RISC System/6000 processors, said Thomas Jarosh, director of Advanced Workstations and AIX Systems at IBM.

The POWERserver 990 is a rack-mounted system with a 71.5-MHz POWER2 microprocessor, 256K bytes of data cache, 32K bytes of instruction cache, 128M bytes of memory expandable to 2G bytes, and 4G bytes of disk expandable to 840G bytes. It is priced from $127,100.



VAN FLEET

The POWERserver/POWERstation 590 and 58H, with 66-MHz and 55-MHz POWER2 microprocessors, respectively, have 256K bytes of data cache, 32K bytes of instruction cache, 64M bytes of memory expandable to 2G bytes, and 2G bytes of disk expandable to 460G bytes.

Pricing starts at $74,450 for the Model 590 and $64,450 for the Model 58H.

INCREASED MANAGEABILITY

IBM's new AIX Version 3.2.5 includes minor changes that enable the operating system to run on the new machines, said Donna Van Fleet, Advanced Workstations and Systems director of Reduced Instruction Set Computing systems software. However, it also incorporates the new Visual Systems Manager to give systems administrators a more user-friendly way to control AIX networks.

"We're taking the complexity out of a systems manager's job because we have synthesized lengthy sets of commands into single drag-and-drop actions," Van Fleet said.

With the initial offering due out in February, Visual Systems Manager will let administrators manage users in groups and control network devices, such as printers and storage management facilities.

IBM's second management tool, DSMIT/6000, previously only supported AIX machines but now lets an administrator manage Sun Microsystems, Inc. and Hewlett-Packard Co. machines from a central RS/6000 workstation.

DSMIT/6000 works with IBM's Systems Management Interface Tool (SMIT)/6000, software included in the base AIX operating system that provides a user-friendly interface.

Together, the products allow users manage regular and diskless workstations, security, performance and electronic messaging services, plus perform resource scheduling for their Unix nets.

"These types of management tools set a new bar for ease of use in Unix systems administration because they give users an intuitive, graphical way to look at and control their entire system," Jarosh said.

DSMIT/6000 for Sun and HP clients will be available in January for $300 per client.

CALLING WORLDWIDE

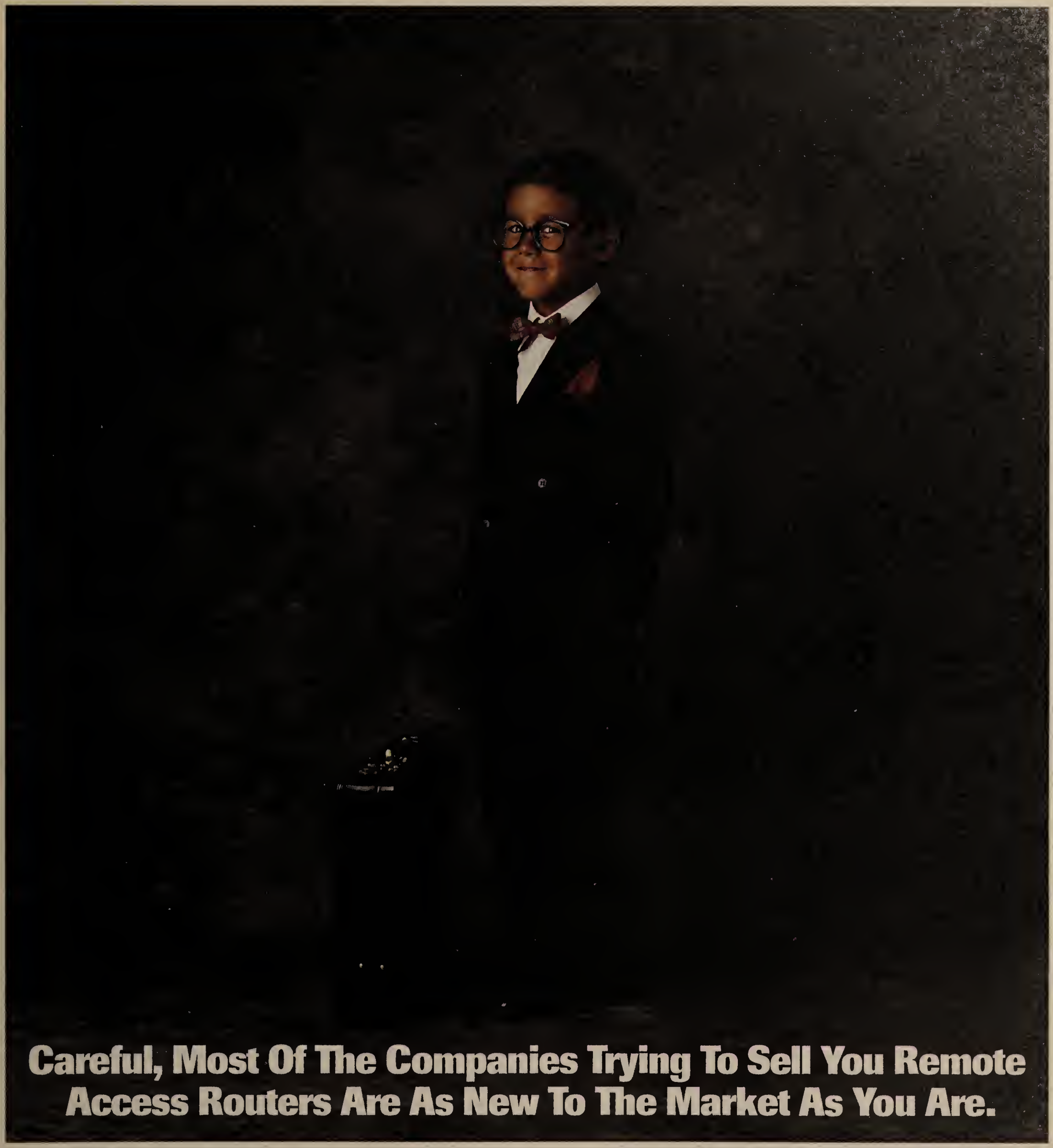
IBM last week became the first vendor to announce an implementation of the DCE directory service with its AIX version.

The global directory service connects individual DCE-compliant directories, called DCE cells, which allow any workstation included in one of the cells to work with another directory to locate a server, workstation or other resource anywhere in the network.

"Having this global directory on your system is like having a worldwide yellow pages right there on your computer because you can locate any node that has an X.500 address and is connected by a DCE network," Van Fleet said.

AIX DCE global directory service will be available Oct. 15, and will cost $195 per client and $2,100 per server.

✆IBM: (800) 426-2468.



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HEALTH CARE REFORM

Clinton admin. to include nets in health program

BY ELLEN MESSMER

Washington, D.C.

Clinton administration officials have outlined plans to make networking and a computer-based electronic patient record system a central part of the health care reform program the president formally introduced to the nation last week.

As part of the effort to reduce paperwork and hold down costs, the federal government intends to put in place a national information network with regional centers for transferring patient data. Under the new relationship with the government that is envisioned under the health plan, insurance providers and hospitals would be expected to use the network to share claims processing information or patients' clinical data.

As a result, there is strong interest in government circles in setting standards for data formats and security, and making them mandatory in the future.

President Clinton, in his address to the nation, called today's medical system "a monument to paper," pointing to the thousands of different forms used in the U.S. "We can save a lot of money if we simplify," Clinton said. "Under the rules, there will be one standard form."

"We need standards for rapid and efficient exchange of data," said Michael Fitzmaurice, a science director for the Department of Health and Human Services.

Fitzmaurice, who presented the administration's plans during an Electronic Industries Association (EIA) conference last week, said standards for patient enrollment, claims, eligibility, payments and remittance documents were now under scrutiny.

The Health Care Finance Administration (HCFA), which is responsible for medical claims processing, has already started planning for greater reliance on networking under the health care reform, said Lisa Salzl, market specialist with Electronic Data Systems Corp., who took part in EIA's survey of federal user computer and communications requirements (see story, page 30).

"The automation of traditional insurance transactions will be a requirement at the start," said Shannah Koss, assistant branch chief at the Office of Management & Budget.

But hospital and insurance providers are already wondering what the costs for upgrading systems may be (*NW*, Sept. 20, page 1).

SMART HEALTH

As Clinton noted in his address to the nation, in the future, every citizen would carry a national heath card stating eligibility for health services. Whether it is a simple magnetic strip or a "smart card," it will contain a unique identifier and information about the bearer.

But debate continues in the administration about whether to base the card on the user's Social Security number or a separate identifier. "There is the fear of Big Brother and the fear of linking health care [information] to other data, such a mortgage [application]," Fitzmaurice said.

Two issues surround HCFA's intent to create the computerized patient record, Salzl said. "The standards must be defined, and the rules to protect patient information must be enforced."

The need to ensure privacy of this patient data requires new legislation to determine when patient information can be shared, Fitzmaurice emphasized, adding that he anticipates the administration proposing a new national privacy law that defines appropriate use of health care data.

But the government's current inability to communicate with itself raises the question of how it can be expected to communicate with the rest of the world.

The Department of Veterans' Affairs (VA), which runs a nationwide hospital system and provides many other benefits, estimates that it disburses $60 million in funds every year to nonqualified recipients such as "dead veterans," said Robert Woods, deputy assistant secretary for Information Resource Management.

"With electronic funds transfer, this money typically goes into a joint checking account, and it's hard to get back," Woods said. But if the Social Security Administration — with its cradle-to-grave knowledge about the citizen — informed the VA, "We should probably pause and stop sending him a check," Woods said.

If the health care plan moves forward as envisioned, standards are likely to become mandatory.

According to Dennis Steinauer, a computer scientist at the National Institute of Standards and Technology, a national health board will be instituted to establish uniform requirements for security of patient information.

The anticipated policy, reflecting the current Code of Fair Information Practices, would make it clear that there could be no secret data systems, that patients would have the right to review their files and the information would only be collected for approved purposes.

Wireless devices keep rolling out

BY ELLEN MESSMER

Washington, D.C.

For users ready to go wireless, the choice of equipment just got bigger last week.

AST Research, Inc. unveiled the first GRiD palmtop computer with optional support for wireless packet-data and spread-spectrum radio. In addition, Wireless Access, Inc. and WildSoft, Inc. — start-ups based in San Jose, Calif. — are ready to make their mark with mobile work force products. Wireless Access is offering an "intelligent" messaging PCMCIA card based on the PCMCIA standard, and WildSoft is unveiling Windows-based software for accessing wireless services.

The 3-pound GRiD PalmPADs1 pen-based computer announced last week contains an optional wireless radio built into its chassis, with a direct connection to the main logic board to process radio data. The GRiD PalmPADs1 supports the ARDIS Co. or RAM Mobile Data, Inc. packet-data networks, as well as Proxim, Inc.'s spread-spectrum radio communications.

OWEN

Wireless Access will officially make its debut at the Telocator Conference in New Orleans this week with AccessCard, which supports messaging over paging frequencies and conforms to the PCMCIA Type II standard. It sports an antenna and 30-day lithium battery.

This card is better suited for hand-held devices, such as the Hewlett-Packard Co. HP 100LX and the Casio, Inc. Z-7000, than laptops because hand-helds have lower power requirements, said Wireless Access President Judy Owen.

The Wireless Access card can receive extensive alphanumeric messages over paging frequencies at speeds from 512 baud to 2,400 baud. "The software in the card will recognize a single message and reassemble it into a single message," Owen said.

But the card's real "intelligence" is in its ability to receive and sort through data sent from an information service or the home office for automatic update of mobile computer applications.

"Our software would alert you that your stock is dropping," Owen said.

Wireless Access plans to sell the card on an OEM basis and has already estalished a relationship with BellSouth MobileComm and SkyTel, Inc., which will resell the device for use in new information services they plan to offer over their paging networks.

Next year, Wireless Access will update its card for messaging with Cellular Digital Packet Data technology or Mobile Telecommunications Corp.'s Nationwide Wireless Network, depending on the extent to which these new packet-data technologies actually get deployed.

Start-up WildSoft's plans remain more mysterious, with the company only promising to develop software that lets mobile workers select access to virtually any local- or wide-area communications.

The company's product plans will be announced in a few months.

The AccessCard will be sold to OEMs for $200, so end users can expect to pay about $400 per PCMCIA card. The GRiD PalmPADs1 starts at $2,319, with the optional random-access memory or ARDIS communications support boosting the cost to $3,559.

The PalmPADs1 with the Proxim spread-spectrum option or a data facsimile modem will cost about $2,899.

✆AST: (714) 727-4141; Wireless Access: (408) 383-1900; WildSoft: (603) 598-3193.

PacBell to offer network mgmt. service

BY BILL BURCH

San Francisco

Pacific Bell wants to be your network manager.

The local exchange carrier last week unveiled a service under which it will manage connection of local lines to long-distance carriers and oversee maintenance and network troubleshooting.

The service lets customers quickly reconfigure their nets, switching the capacity on a line or jumping from one long-distance carrier to another in a matter of hours.

Off-loading net management to Pacific Bell will encourage customers to take advantage of multiple long-distance carrier offerings, rather than relying on a single carrier for simplicity sake, the company believes.

For example, rather than sticking with AT&T, a company might try a third-tier carrier for lower prices, all the time backed up by an alternate routing plan kept in Pacific Bell's network.

Pacific Bell has tariffed the network management service at relatively low prices. For example, keeping a backup routing plan available for a T-1 line costs only $15.60 per month. For the network management service, Pacific Bell is using the FlexCom intelligent network controller program, the same system platform Nynex Corp. is using for its network management system.

The network management service is part of Pacific Bell's new Optimizer voice and data service line for large corporate and government customers. Some 60% to 70% of the telecommunications budgets of large companies is spent on long-distance carriers, according to Kristine Curran, Pacific Bell Optimizer product manager, and those heavy expenditures may encourage companies to try alternative carriers.

For the local loop, Pacific Bell's network management service will only cover its network, effectively shutting competitive access providers out.

The service also wrests away account control from the long-distance carriers, which will be relegated to the role of providing pipes, according to Joe Noel, director of network research with Dataquest, Inc. in San Jose, Calif.

For users, the service makes most sense for companies in California.

Firms team to manage SNA, TCP/IP nets

BY MICHAEL COONEY

Herndon, Va.

LEGENT Corp. and Hewlett-Packard Co. last week promised to jointly develop systems and network management applications designed to integrate and simplify control of devices on Systems Network Architecture and distributed TCP/IP nets.

Beginning in the first quarter of 1994, LEGENT will license and distribute HP's OpenView-based performance applications, such as PerfView and Performance Collection Software, which collect net performance data from devices on distributed Transmission Control Protocol/Inetnet Protocol nets. OpenView is HP's distributed network management platform.

The companies then will begin integrating the OpenView applications on top of LEGENT's recently announced Paramount net and systems management platform (*NW*, May 24, page 9).

See **HP, LEGENT**, *page 11*

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New NetDirector offers automated IP address mgmt.

BY SKIP MACASKILL

Santa Clara, Calif.

Ungermann-Bass, Inc. last week offered an aspirin to net managers suffering from IP addressing headaches when it rolled out a management application that automates address maintenance for TCP/IP nets.

The application was the highlight of the features unveiled in Version 17 of NetDirector for OS/2, the lastest release of UB's management software, which also included automapping and automated problem response capabilities.

BILL O'CONNELL

MORETTI

NetDirector 17.0 eliminates the need for net administrators to manually assign and track the plethora of IP addresses needed in a large Transmission Control Protocol/Internet Protocol net. When installed, NetDirector will "discover" all IP devices on a network, logging their addresses to its database. As new devices are added, NetDirector will automatically generate an address and assign it to the device after checking its database to ensure that the address is not a duplicate.

The new version will automatically display IP devices on an icon-based topology map, allowing the administrator to choose how those devices will be displayed. Only hubs and routers, for example, could be displayed, rather than all end nodes.

UB also integrated NetDirector's SQL database more tightly with the NetDirector management console to let administrators issue NetDirector commands while navigating the database. As a result, users can sort devices in the database and automatically create groups on the map.

For example, an administrator can sort the database to identify all routers and include them in a single map group that makes it easier to see their status.

"Previously, there was no way to link the results of a database query back to the topological map," said Didier Moretti, general manager of UB's network management business unit. "By providing that linkage, we can reduce time spent on routine management tasks."

An automatic fault action function has also been added to NetDirector 17.0 that automatically sets responses to alerts and alarms in motion. For example, NetDirector could notify an administrator by pager, electronic mail or trouble ticket when a device begins emitting an excessive number of bad packets.

"We're helping users reduce the cost of network ownership by automating and simplifying net management tasks," Moretti said.

UB also said Windows-based applications can be integrated with NetDirector, so the same personal computer platform, user interface and SQL database can access NetDirector functions and applications.

"Supporting Windows applications in native mode will ease net management," Moretti said. "We will also provide a software developers' kit that will let users add their own applications and management tools."

NetDirector 17.0 is currently available on OS/2 1.3, with support for OS/2 2.1 expected by the next quarter. The enhancements will also be available for the Unix version of NetDirector in the near future.

Both versions are priced from $3,995 to $17,500, depending on configuration.

✆UB: (800) 777-4526.

HP, LEGENT

Continued from page 9

Paramount integrates a variety of LEGENT's previously stand-alone network and systems management applications. For example, the company's LANSpy local-area network performance monitor and its NetSpy, an SNA device performance monitor, will now report LAN and SNA performance data back to a single Paramount monitor.

Once the OpenView applications are integrated with Paramount, users will be able to monitor the performance and capacity of both their SNA and TCP/IP nets from a single personal computer-based Paramount console. In the future, OpenView users will also be able to display Paramount data on the OpenView screen.

"Users will be able to gather enterprise management data from anywhere in their net and see it from one console," said Phil Carrai, vice president of product management for LEGENT. "The LEGENT and HP combination will help users bridge the gap between managing their legacy platforms and new distributed networks.

Carrai said that once the two platforms are integrated, the companies will build new applications, such as enterprise capacity planning and response-time monitoring applications, that can run in both the HP and Paramount environments. These new applications could appear by the end of 1994, he said.

A joint database repository where Paramount and OpenView can store and gather data is also in the works but will not be available until 1995.

Users said the LEGENT-HP products could help them manage an increasingly complex environment.

"Managing both the legacy and client/server, TCP/IP devices is something that can't be done today," said David Ward, manager of operations at the American Greetings Co. in Cleveland, Ohio. "A single management monitor and repository would go a long way toward helping us manage a complicated environment."

✆LEGENT: (703) 708-3000; HP: (415) 691-5833.

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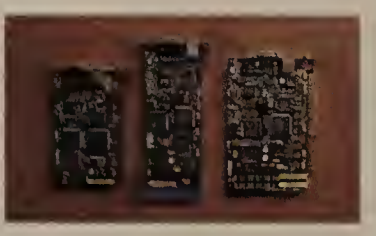
Okay, so there are a few buyers who don't care that Proteon's ProNET-4/16 Plus adapter cards average 57 years MTBF. Or that they're backed with a Lifetime Warranty. But the rest of you will be interested to know that our new Token Ring cards aren't just reliable, they're also extremely fast. That's because they utilize Texas Instruments' new PacketBlaster chip. A dramatic speed improvement



on cards that had already won performance awards from both *Data Communications* and *InfoWorld*. Naturally, the ProNET-4/16 Plus series is available in ISA, MCA and EISA cards, and is guaranteed 100% interoperable with your applications. Something adapter card buyers of all ages can appreciate.

proteon

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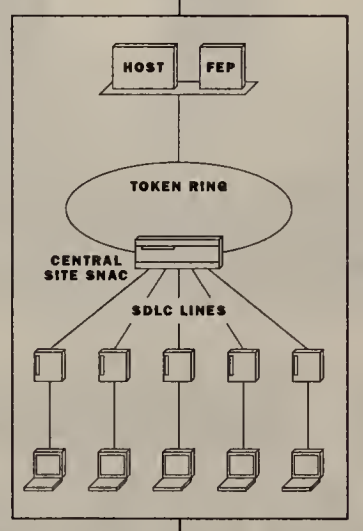
"IF I TELL YOU HOW MUCH MONEY SYNC'S CENTRAL SITE SNA CONVERSION SAVED ME AT [redacted], I'M DEAD MEAT."

Get the competitive tool companies would rather keep to themselves. The Central Site SNA Conversion Node (CS SNAC) lets you downsize or eliminate FEPs now, and painlessly open your SNA network, with a platform for the further evolution of internetworking. It's available only from Sync Research, the most trusted name in internetworking SNA.

"Once we saw the power of Sync, we told the reps from [redacted] and [redacted] to get lost."

Short-term, the CS SNAC offers potential savings of literally hundreds of thousands of dollars in reduced front-end processor costs. Longer term, by opening SNA, your huge SNA network investment can evolve gracefully, adopting key new technologies and standards like frame relay or APPN as they become appropriate.



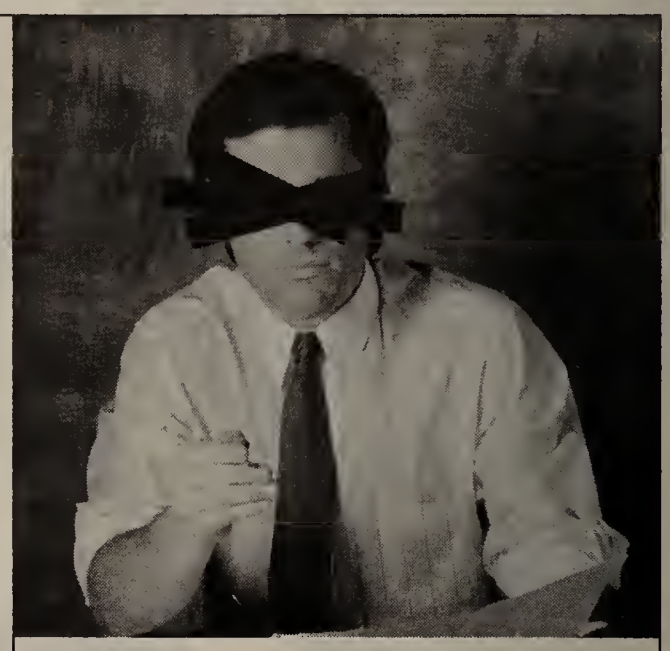
"Our headquarters in [redacted], was the hub of our SNA network. The trick was to increase access to our SNA hosts without killing ourselves financially. Adding [redacted] front-end processors to our network was going to cost [redacted] up front, plus [redacted] every six months in service."

SDLC requires significant FEP resources. But a single CS SNAC can replace up to 28 direct connections, supporting—via multidrop—hundreds of PUs. You can use much smaller FEPs or, in remote concentration applications, replace them entirely.

"The guys from Sync met with me and my boss at [redacted]. They showed us how to save about $[redacted] over the solutions from kingpins like [redacted], and the self-proclaimed [redacted] gurus."

Sync specializes in large-scale SNA connectivity. With over a decade of experience in IBM environments, Sync is expert in maximizing availability and minimizing costs.

"The others are just trying to slap your SNA sessions onto the LAN. Managing my [redacted] SNA traffic is too important to trust to that kind of a kluge. We just said, 'If we've got to do it, let's do it right.' Now our billing people in [redacted] can connect with [redacted] data located in [redacted] with the level of reliability we need."



"This technology is our secret weapon. Hey, you're not recording this, are you?"

[redacted]
Network Manager, [redacted] Inc.

The Sync CS SNAC is 100% compatible with token ring, RS-232, V.35 and V.11 interfaces. It can be fully managed from the NetView console, is NetSpy compatible, and is as tightly integrated into SNA as a native IBM device.

"End result? This puts us head and shoulders above our key competitors: [redacted] and [redacted]. I just hope they don't find out about it."

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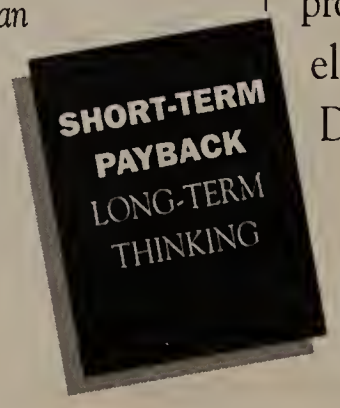

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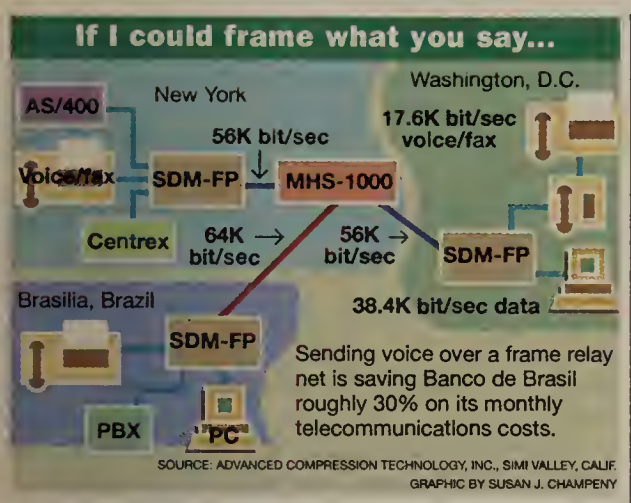

Bank goes global with frame relay

BY JIM DUFFY

Brasilia, Brazil

Banco de Brasil, the largest bank in Brazil, plans to funnel voice traffic over a global frame relay network as part of its strategy for cutting network costs.

The bank is installing the frame relay network and expects to reduce its monthly telecommunications expenses, which are total more than $1 million, by 30%. Voice traffic will share the same access and backbone circuits with facsimile and data.

Sending voice over frame relay networks has not met with widespread adoption for fear of transmission delay, jitter and discarded packets due to congestion. But Banco de Brasil's network may convince the naysayers that there is no need to worry, said Tom Spadafora, vice president of marketing for Advanced Compression Technologies, Inc. (ACT), the bank's frame relay equipment provider.

ACT's access muxes and backbone switches will link 32 sites in 26 countries over leased 56K and 64K bit/sec lines. In a few cases, dial-up lines will link remote sites with a small amount of backbone-bound traffic to hub sites, Spadafora said.

ACT's ACTnet MS-1000 frame relay switch will be installed in five hub sites to form the backbone. The sites — Brasilia; Buenos Aires, Argentina; London, New York and Tokyo — will be interconnected in a near-mesh topology over 64K bit/sec circuits. Tokyo will be connected only to New York, but all other backbone sites will be connected to at least two other locations for redundancy.

The MS-1000 switches will be able to dynamically reconfigure the network to route around failed backbone circuits, Spadafora said. The switch can detect when a physical port or a permanent virtual circuit is down, and route to another available trunk.

Branch office sites will be equipped with ACT's ACTnet SDM-FP frame relay access muxes. The multiplexer will take in voice, fax, local-area network and terminal data traffic, wrap it into variable-length frames and send it to the backbone over 56K bit/sec access lines in the U.S. and 64K bit/sec lines overseas.

Currently, the bank uses public-switched services for voice and fax, and a few leased lines for data transmission, an ACT spokeswoman said. The private frame relay network will generate savings by allocating bandwidth on a single trunk to voice, data and fax.

For voice transmission, ACT has tuned its equip-

See **Bank**, *page 15*

Big Blue reshaping its corporate tree — again

New business strategy focuses on teamwork.

BY MICHAEL COONEY

Armonk, N.Y.

IBM's latest round of corporate musical chairs promises to corral the computer giant's fragmented, independent business units and get the company moving forward as an integrated machine.

With an eye toward building teamwork rather than dealing with patchwork, IBM Chairman Louis Gerstner has formed the Corporate Executive Committee that will focus on companywide results and making IBM business units work in unison rather than independently as they have for the past couple of years.

"I have reached the firm conclusion that decentralization vs. centralization is not our most important organizational dilemma," Gerstner wrote in a memo issued to IBM employees on Sept. 13.

Joining Gerstner on the new committee are Senior Vice Presidents Jim Cannavino, Gerry Czarnecki, Ellen Hancock, Bob LaBant, Ned Lautenbach, Bernard Puckett, Paul Rizzo, John Thompson, Pat Toole and Jerry York.

Their compensation will be based on companywide results, and each will report directly to Gerstner.

The new strategy could have an immediate impact on IBM's Networking Systems business since Gerstner tapped Hancock, its senior vice president, to be part of a new IBM corporate executive committee.

Hancock will continue to oversee Networking Systems from a corporate level, but she will now have the added responsibility of overseeing IBM's Software Solutions, the company's high-end software system division. As a result, Hancock will soon name a new Networking Systems president to oversee daily duties for that group, IBM said.

Analysts said the move will not mean as much to the daily operations of Networking Systems as it will to Software Solutions.

"Ellen [Hancock] has wanted to shake up that group for a long time and now she'll have the chance," said Frank Dzubeck, president of the Communications Network

See **IBM**, *page 15*

ROUTERS

Microcom unveils two new low-end routers for its MBR line

BY MAUREEN MOLLOY

Norwood, Mass.

Microcom, Inc. last week expanded its product offerings with the introduction of new low-end routers targeted at users that want to link remote sites into a central site internetwork.

The circuit-switched Microcom Bridge Router (MBR)/6003 and packet-switched MBR/6503 are three-port devices that support a single local-area and two wide-area network links. Both support the routing of Transmission Control Protocol/Internet Protocol and Novell, Inc. Internetwork Packet Exchange (IPX) data.

The MBR/6003 links an Ethernet or token-ring LAN to a single leased or dial-up line, as well as to Integrated Services Digital Network or Switched 56 wide-area network services.

The second WAN port can be configured to support Microcom's WANmiser Advantage software suite that supports an Automatic Bandwidth On Demand function whereby the device automatically dials an additional circuit-switched line during heavy traffic periods.

A second WANmiser capability is IPX Autodial, which automatically dials connections to remote sites only when data transfer is needed, cutting the expense of maintaining a permanent leased line.

The MBR/6503 supports a single Ethernet or token-ring LAN and two frame relay or X.25 packet-switched links at speeds up to 384K bit/sec each.

Each WAN link supports as many as 15 virtual circuits, giving a single 6503 connectivity to 30 remote sites.

The MBR/6003 and MBR/6503 for Ethernet cost $2,699 each, while token-ring versions of each cost $3,599. All are available now.

PRICE REDUCTIONS

In a related matter, Microcom also announced price reductions of as much as 27% on its higher end five-port routers. The MBR/6000 and MBR/6500 Ethernet routers now cost $3,799, while the MBR/6000 and MBR/6500 token-ring routers now cost $4,199.

The vendor also dropped the price of its MBR Manager for HP OpenView network management system to $499 from $2,999.

✆Microcom: (800) 822-8224.

BRIEFS

Newbridge Networks Corp. last week was awarded a $3 million contract by Instrimpex Equipment Import and Export Corp. to supply digital communications equipment for three networks in China, including the Yunnan Post and Telecom Administration, the Zhejiang Electric Power Bureau and the Jilin Electric Power Administration Bureau.

Network Equipment Technologies, Inc. (NET) last week announced that it has renewed its strategic relationship agreement with IBM Networking Systems that gives IBM worldwide marketing, installation and service rights for NET's IDNX product line. The two will also work together to provide interoperability between the IDNX and the Transport Network Node (TNN), the Asynchronous Transfer Mode switch IBM currently has under development.

NET also was awarded a $1 million contract by Florida Power Corp. to install a high-speed broadband net to interconnect the utility company's routers and its Synchronous Optical Network rings.

Network Systems Corp. last week announced that it has delivered the world's first HIPPI-over-SONET OC-12 gateway to the Department of Defense. The department will use the link as a gateway into its emerging Synchronous Optical Network infrastructure to move large amounts of information between supercomputers and high-performance workstations.

SONET is a high-speed fiber-optic transmission standard, and the High Performance Parallel Interface is a data transfer standard that supports speeds 80 times faster than traditional nets such as Ethernet. Network Systems' gateway will support HIPPI connections that stretch thousands of miles, enabling users to transmit data at very high speeds across the country or the globe.

Network Systems: (612) 424-1532.

Memorex Telex Corp. last week announced that it has installed more than 13,000 new Memorex Telex Systems Network Architecture net controllers, displays and printers at **Chrysler Corp.** production sites and offices throughout the U.S. and Canada. Much of the equipment is used to drive the on-line broadcasting system employed by the automaker to sequence motor vehicle assembly processes.

APPLICATION SYSTEM/400

IDEA processor to provide multiple access to AS/400

BY MAUREEN MOLLOY

Billerica, Mass.

IDEA last week announced an enhanced version of its communications processor that gives token ring-attached devices simultaneous access to multiple IBM AS/400s and other host devices.

The IDEA Concert Communications Processor 2.1 also comes equipped with routing functionality that enables users to merge IBM Systems Network Architecture and local-area network traffic on common wide-area network links.

According to Cindy Santisario, research manager of computer networking architectures at International Data Corp., a Framingham, Mass.-based market research company, the IDEA Concert supports all the capabilities of an IBM 5494 controller and then some.

"IBM's been conservative in the features and functions they've brought out in the 5494."

"IBM's been conservative in the features and functions they've brought out in the 5494, and IDEA's been able to leapfrog IBM," Santisario said. "By adding the internetworking piece, it can now take advantage of the move toward consolidated nets as users begin integrating their SNA and LAN traffic."

Using the Concert Crossover integration capability, a user at a terminal or personal computer can toggle simultaneously between applications on various hosts, including mainframes and Application System/400, System/36 or System/38 mid-range systems, as well as Digital Equipment Corp. VAXes. An IBM 5494, in contrast, can only support one session per user at a time.

The IDEA Concert can support from 16 to 84 devices and is outfitted with an integrated multiprotocol router. The three-port router is equipped with two wide-area ports supporting speeds up to T-1 and a single token-ring or Ethernet port. It can handle Transmission Control Protocol/Internet Protocol and Novell, Inc.'s Internetwork Packet Exchange (IPX) data.

SNA SUPPORT

To support SNA traffic, the device is equipped with a so-called SNA Datastream Management (SDM) feature that extracts the data stream from an SNA Path Information Unit and splices a TCP/IP Layer 3 net address onto it. The data is then routed to another Concert device that strips off the TCP/IP envelope and transmits it to the SNA host.

IDEA Vice President David Hunter said SDM combines routing, host gateway and terminal controller features, and is equipped with an integral Synchronous Data Link Control-to-Logical Link Control 2 conversion capability, thereby eliminating the need for an external conversion device.

He added that SDM contains functions similar to IBM's Data Link Switching (DLSw). DLSw, a proposed Internet Engineering Task Force standard for supporting the transmission of SNA data across TCP/IP nets, lets routers locally acknowledge receipt of SNA frames on behalf of remote devices, and provides WAN bandwidth conservation features and link-layer flow control mechanisms for SNA devices, among other functions.

The Idea Concert Communication Processor is available now and ranges in price from $3,820 for a 16-port device up to $17,470 for an 84-port device.

✆IDEA: (508) 670-8512.

Network Automation jumps into remote internetworking fray

New router to support voice and video over 1 WAN link.

BY MAUREEN MOLLOY

Northborough, Mass.

Network Automation has announced a PC-based router that will support and prioritize data, voice and video traffic over a single wide-area network link.

The Workstation Interface Node (WIN) is an Industry Standard Architecture- and Extended ISA bus-compatible card that links both stand-alone workstations and local-area network-attached servers to other LANs or host devices, thereby providing users with a low-cost alternative to stand-alone routers.

In addition to data, the device supports voice and video traffic and provides the latter with the priority it demands by assigning as many as eight levels of priority to each application.

The router card is equipped with three wide-area ports, two of which support X.25, frame relay and leased lines at speeds up to T-1, while the third supports speeds up to 16M bit/sec.

It also includes software that enables it to function as a gateway for LAN-attached devices that need to link to remote IBM, Unix System Laboratories, Inc., Digital Equipment Corp., Tandem Computers, Inc. and Fujitsu, Ltd. host systems.

The WIN routes Transmission Control Protocol/Internet Protocol, DECnet, Novell, Inc.'s Internetwork Packet Exchange (IPX) and AppleTalk traffic over the wide-area link.

It will also support the key bridging algorithms — including spanning tree, source routing and source routing transparent — as well as the Routing Information Protocol and the Open Shortest Path First inter-router protocols.

The router, which can be managed from a Simple Network Management Protocol-based network management system, costs $2,995 and is available now.

In a related matter, the vendor said it will roll out early next year an Asynchronous Transfer Mode-based hub, as well as a separate videoconferencing system that will sell for less than $5,000. The company declined to provide additional details.

✆Network Automation: (508) 393-1777.

IBM rolls out new products to improve 3745 models

BY MICHAEL COONEY

Raleigh, N.C.

As expected, IBM last week rolled out products that allow its front-end processor to support twice as many Token Ring-attached devices and better throughput to the mainframe.

All of the new features are built into the 3745 Communication Controller's expansion frame — the 3746 Model 900, which is a chassis coupled onto existing 3745 Models 210, 310, 410 and 610 (*NW*, Sept. 20, page 1).

IBM also increased the number of adapters the 3746 can hold from four to 10 by adding a new adapter rack to the 3746.

IBM has enhanced the 3746 microcode to enable the box to support 2,000 Token-Ring devices, up from 1,000.

Additionally, a new Enterprise System Connection (ESCON) II adapter sports 1 1/2 times the throughput of the existing ESCON I adapter. ESCON is IBM's fiber-optic mainframe channel architecture.

Finally, the 3745 can now support unshielded twisted-pair wiring so users can, for example, link the 8250 LAN Hub directly to the 3745.

There is no charge to increase the amount of Token-Ring devices supported by the 3746. The ESCON II adapter costs $20,700. The new adapter rack for the 3746 costs $14,500.

All of the products will be available Oct. 29.

✆IBM: (914) 642-6238.

Comments

If you have a comment on this or any other article, drop us a fax at (508) 820-3467 or call (800) 622-1108, Ext. 487.

Bank

Continued from page 14

ment to address the delay, jitter and congestion concerns. The SDM-FP muxes will first digitize and compress voiced signals before mapping them into variable-length frames. To ensure minimal transmission delay, ACT developed a so-called "fair share" algorithm that assigns a high priority to voice traffic, medium priority to fax and low priority for data.

The fair share algorithm also eliminates packetization of silent pauses in voice, which increases bandwidth efficiency, ACT said.

In addition, the algorithm includes Digital Speech Interpolation, which allocates high-priority bandwidth to fax and data when speech is not detected.

The SDM-FP limits voice frames to 83 bytes, which further minimizes delay and jitter because the small frames are easier to buffer.

To handle congestion, ACT developed a "predictive" congestion management algorithm that enables the endpoint SDM-FP muxes to sense a congestion situation.

When buffer queues start to fill up, the SDM-FP sends a frame to the transmitting node telling it to lower its transmission rates.

Banco de Brasil is now funneling voice over frame relay between the Brasilia and New York hubs, and up to the New York switch from SDM-FPs in Chicago, Los Angeles, Miami, San Francisco and Washington. This marks the completion of the first phase of the bank's network project.

The other hub sites are expected to come on-line by the end of this year.

IBM

Continued from page 14

Architects, Inc. consultancy in Washington, D.C. "I expect we'll see her take action there quickly, like streamlining production."

LINKING BUSINESSES

Others said the move would help IBM link two of its most important businesses — networking and software.

"IBM will now have one of its best people leading the development of networking and distributed systems," said Sam Albert, president of Sam Albert Associates, a consultancy in Scarsdale, N.Y. "It also shows Gerstner's commitment to client/server computing because the people running the PC, mainframe, net equipment and software can now all act as one unit."

The new structure also reflects the diminishing role of IBM's mainframe product line. Under the new plan, the mainframe unit — previously known as Enterprise Systems — now falls under the charge of Thompson's mid-range AS/400 Division. It will now be called the Large Scale Processors Division.

In fact, Gerstner decreed that all of IBM's business units will now be known as divisions rather than the nondescript and sometimes confusing "line of business" designations of the past.

"This set of changes is not aimed at seeking the final answer [to product groupings]," Gerstner said. "The corporate executive committee will consider on a regular basis how to shift various segments of our businesses to reflect the evolution of our marketing and technology strategies."

Analysts said one of the keys to the new IBM corporate structure will be to get rid of the red tape and rigid rules created in the past.

HANCOCK

"IBM calls this new committee the Corporate Executive Committee, or the CEC, but I call it the GIC — 'Gerstner's Inner Circle,' " Albert said. "Gerstner has hand selected the 10 people who will now carry the fate of IBM's future in their hands."

Compaq Would Like To Make An Announcement Of Staggering Proportions.

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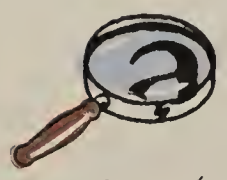
This is a story about a small computer engineered to be so dependable, you won't think twice about trusting it with your mission-critical applications. And to be this without filling a closet, much less a room. If you haven't thought of Compaq as an enterprise-critical platform before, we invite you to grab your bifocals and begin. (We'll be cramming a lot of information into this ad, which, given how much we managed to fit into our new servers, only makes sense.)



If there's one thing we've learned working with our customers, it's that you're running more and more mission-critical applications on your network. And if your network goes down, your business goes down. All of which makes the introduction of the new Compaq ProLiant Server even more timely.

The ProLiant is a new family of affordable, high-performance, easy-to-manage servers engineered specifically to provide the high availability you need for mission-critical networks. We've designed ProLiant in three different models, ranging from a single-processor configuration to a four-Pentium processor model.

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Still, no network's perfect. In the unlikely event problems occur, our server exhibits remarkable tolerance. Every ProLiant includes Compaq-designed hot-pluggable drives. ProLiant Models 2000 and 4000 come standard with advanced error-correcting memory and off-line backup processor features (whereby the server reboots automatically to a second processor). And, most notably, the Compaq Smart SCSI Array Controller together with the ProLiant Storage System ensures mission-critical data integrity. Should a network problem bring the server down, the Rapid Recovery Systems of the ProLiant are designed to bring it back up.

VER IS A MAINFRAME WITH AN ATTITUDE.

For example, Automatic Server Recovery 2 uses a historical record of server status and performance to perform an astonishing array of tasks. Like intelligently restarting the server, automatically correcting a variety of problems, and accessing a telephone pager to contact network administrators.

By now you'd expect us to have rethought server setup, configuration and OS installation, but you might be surprised by the results. Introducing SmartStart, a CD-ROM system that takes the headache out of getting your server up and running. ProLiant includes a CD-ROM drive and bundled CDs of optimized Netware and other major operating systems. To get hooked up to your network operating system, simply call your dealer for an access code, enter it, answer a few questions, and leave. Minutes later—say, after you've enjoyed a cup of coffee and a jelly donut—you'll return to find an integrated OS fully installed and optimized for increased performance and improved management. And we'll keep you updated via CD when new operating system versions appear.

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All in a surprisingly small box for not a whole lot of money. In fact, a DX2/66 Compaq ProLiant 1000 starts at about $6000‡.

Which may help to explain the look your boss gives you when he hears how much money you've saved: stunned admiration. But you'll get used to that. It goes with the territory. For more information on the new Compaq ProLiant servers, or for the location of an authorized Compaq reseller near you, just call us at 1-800-345-1518. If you'd like to receive model, feature and specification information immediately via fax, select the PaqFax option. Or, if you'd like that information even sooner, just turn the page.

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Standard Disk Controller	Integrated Fast SCSI-2 and Smart SCSI Array Controller (selected models)		
Storage Capacity	550MB–112GB Internal/external	1050MB–140GB Internal/external	1050MB–140GB Internal/external
Typical Usage	Departmental network services—primarily NetWare	Departmental network application services—NetWare, NT and Unix	Application services for preemptive downsizing—NT and Unix
Transaction Rating	50–150 TPS	200–300 TPS	300–400 TPS
Estimated Starting Street Price‡	$6,000	$8,900	$13,900
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INTERNETWORKING MONITOR

by Scott Bradner

The Internet: Why now?

The Internet is suddenly popular. Now, by "the Internet," I don't mean that travel agency in Washington, D.C., I mean the international mesh of interconnected data networks.

For reasons best known to the media gods, writing articles about the Internet seems to be the thing to do these days. In a 2 1/2-month period last year, there were about 22 articles mentioning the Internet in major U.S. publications; this year, in the same time period, there have been more than 170.

A major newsmagazine, which only a few months ago had a cover story about the National Information Infrastructure without mentioning data transfer — they seem to think, along with the majority of the telephone companies, that an Information Infrastructure is a way to build an automated video store — just recently had an article of almost the same length that touted the usefulness, power and scope of the Internet.

The Internet has even shown up on the newspaper comic pages (*Dilbert*) and *The New Yorker*. Newspapers from *The Boston Globe* to *El Mercurio* in Santiago, Chile, publish Internet electronic mail addresses for readers wanting to send electronic letters to the editor.

Last month, I even found an article on the Internet in an airline flight magazine. I don't read *The National Inquirer* (well, other than the cover when waiting in the supermarket checkout lane), but I would not be surprised if they had articles claiming that extraterrestrials were monitoring the E-mail traffic and were participating in some of the mailing lists. (Come to think of it, that might explain some of the postings I've seen recently. Some of those people seem to be particularly clueless.)

All of this attention is flattering to those of us who have been proselytizing this technology for years. The problem is that I don't see any logical reason for the current attention.

The Internet has been around and growing for more than a decade. Sure, it's big (almost two million interconnected computers worldwide) and growing fast (more than 7% a month), but it's been big and growing fast for quite a while now.

It was certainly growing at least this fast when *Time* and *Newsweek* were forecasting national video parlors for the kiddies, instead of international, on-line, interactive current affairs in the schools.

I'm sure it helps to have a national administration that understands something about data networking; "understanding the gestalt of a gigabit network" (whatever that means) as Clinton said about Gore.

But administrations have "understood" things in the past that never broke the surface tension of carefully cultivated ignorance that is the modus operandi of the Fourth Estate.

Since I'm a member and a trustee of the Internet Society, it would be nice to think the attention given to the Internet is a result of activities of the Internet Society. Last month's meeting drew more than 850 people from 91 countries. But I expect that would be hubris.

That does not leave me with other rationale except the natural herd instinct of the press. To paraphrase Massachusetts Institute of Technology's Dave Clark, they stand around in clusters like penguins on an ice flow. If one of them slips in and does not disappear, the rest suddenly think the water is fine and jump in.

I hope it is more than that. Perhaps we in the Internet have passed some threshold of penetration. Because of that, more people are reaching the understanding that, as I said in an earlier column, connectivity — data connectivity — is the "killer application" the media and phone companies have been waiting for. They may even finally see that it has been here all along for a growing number of us.

If you have any other explanations, please let me know.

Disclaimer of the month: From Jason Hernandez — "My typing = my opinion. Read the trade magazines for my employer's opinion."

Bradner is a consultant with Harvard University's Office of Information Technology. He can be reached via the Internet at sob@harvard.edu.

INTERNETWORK MANAGEMENT

Understanding SNMP and SNMPv2

According to IDC (International Data Corporation), the installed base of internetworking devices has been growing at an average annual rate of over 65% for the past four years.

With this explosive growth comes the need for network management systems to simplify management operations. The SNMP (Simple Network Management Protocol) has rapidly become the de facto standard for these management systems.

In this information packed one-day seminar, you will acquire a thorough understanding of the elements of an SNMP-based network management system, how to implement SNMP with your internetwork, plus the various enhancements such as the new message formats, improved error codes and security with SNMP version 2.

A special feature of this seminar are case studies, taken from live networks, and demonstrated with a Network General Sniffer® protocol analyzer.

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9/29/93	**Washington, DC** ANA Hotel
10/13/93	**Los Angeles, CA** LAX Marriott
10/14/93	**San Francisco, CA** S.F. Marriott
10/15/93	**Seattle, WA** Westin
10/19/93	**Detroit, MI (JUST ADDED)** Holiday Inn/Livonia
10/20/93	**Atlanta, GA** Marriott Perimeter Ctr.
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- Learn the details of the three key elements of the Internet Network Management framework: the SMI, the MIB and the SNMP.
- Survey the key elements of Abstract Syntax Notation One (ASN.1), the language used to define SNMP message formats.
- Understand how TCP/IP and the related Internet protocols such as UDP and IP support SNMP.
- Learn how test equipment that supports the Remote Monitoring (RMON) MIB can assist with distributed LAN management.
- Understand the enhancements found in SNMPv2, such as Manager-to-Manager communications, the GetBulk Protocol Data Unit, and enhanced Security.
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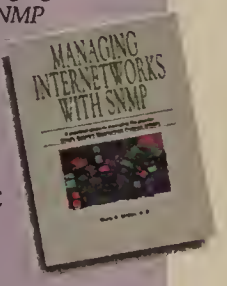

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SWITCHING HUBS

Plaintree offers up its Ethernet switching plan

BY SKIP MACASKILL

Wellesley, Mass.

Plaintree Systems, Inc. this week will unveil an Ethernet switching hub line based on its fast bridging technology, which combines the speed of switching with the fundamentals of bridging.

The new WaveSwitch series consists of an 18-port work group hub and a chassis-based model that can support as many as 112 ports of dedicated Ethernet or a combination of 28 ports of Fiber Distributed Data Interface and 100M bit/sec Ethernet.

The fast bridging technology is incorporated in a series of custom application-specific integrated circuit chips developed by Plaintree that provide an enhanced form of store-and-forward switching.

The Plaintree approach is a combination of cut-through switching, which forwards a packet as soon as its address header enters the switch, and store-and-forward switching, which waits until the entire frame has been accepted before it is forwarded.

See **E-net**, *page 28*

BRIEFS

Network General Corp. this week is expected to add Ethernet Remote Monitoring (RMON) capabilities to its Distributed Sniffer System (DSS), allowing users to combine DSS' expert analysis capabilities with the RMON application to monitor and analyze remotely collected data from central DSS consoles.

New products available include RMON agents for both personal computers and servers, as well as a SniffMaster for RMON Console, which analyzes the collected information. Pricing ranges from $2,995 to $9,495, depending on configuration.

Network General will also announce that it has signed an OEM deal with Madge Networks, Inc. to resell Madge Networks' Smart 16/4 AT Ringnode token-ring adapters for its AT portable Sniffer and DSS products.

Network General: (415) 473-2000.

Cabletron Systems, Inc. last week reported record operating results for the second quarter ended Aug. 31. Sales of $141.9 million represent a 47% increase over sales from the corresponding period last year. Net income increased to $28.3 million, up from $19.3 million for the same period in 1992.

Tricord Systems, Inc. last week announced two additions to its PowerFrame server family. The PowerFrame Model 20 is positioned as a work group or small departmental server, and comes equipped with an Intel Corp. i486-DX2 66-MHz CPU, 16M bytes of main memory, single 425M-byte disk drive, eight-slot Extended Industry Standard Architecture (EISA) bus, built-in graphics accelerator, keyboard, mouse and 3.5-in. floppy disk drive.

Redundant Array of Inexpensive Disks (RAID) 0, 1, 4 and 5 are also standard.

The PowerFrame ES4000 is geared for large departments and includes one i486-DX2 66-MHz microprocessor, 525M bytes of disk storage a nine-slot EISA bus, one EISA-independent I/O processor that supports up to 14 Small Computer System Interface devices and both a 3.5- and 5.25-in. floppy drive. RAID 0, 1 and 10 come standard, with RAID 4 and 5 optional.

Available now, the Model 20 and ES4000 cost $9,900 and $43,900, respectively.

Tricord: (612) 557-9005.

McAfee Associates, Inc. has rolled out Version 1.5 of its NetShield antivirus software for Novell, Inc. NetWare file servers. The new version now detects 2,017 known file server viruses and offers a high-performance scanning algorithm to improve speed when scanning large files. Networkwide automatic antivirus NetWare Loadable Module synchronization has also been added, which automatically installs the most recent NetShield version on all the servers in the net. That eliminates the need to do the task manually.

The 1.5 software costs $495 for the first file server and includes two years of free updates.

McAfee: (408) 988-3832.

VINES 5.5 receives long-awaited recognition for network security

NOS offers security and control architecture.

BY MARK GIBBS

Much fanfare has been made about NetWare 4.0, but a recent evaluation of Banyan Systems, Inc.'s VINES 5.5 uncovered a mature NOS that is well suited to enterprise networks. With a powerful global directory service at its heart, VINES offers a solid security and control architecture.

VINES is not without its limitations, however. Currently, it lacks the ability to replicate user authentication services and does not enforce disk space quotas — two important features that NetWare 4.0 provides.

Banyan has been working with the National Security Agency to get VINES certified for a C2 government security rating — one that will assure users of industrial-strength security. Recently, however, this certification program was put on hold pending unannounced enhancements to VINES that Banyan says will affect security. Banyan said the certification process should resume soon, but it was unable to provide a firm date or disclose information about the enhancements.

VINES' ROOTS

Launched in 1984, VINES is one of the most mature network operating systems available. Until the introduction of NetWare 4.0 this past spring, Banyan was the only vendor to offer enterprisewide security and network services.

VINES is based on Unix System V (included with the system) or SCO Unix, and consists of a set of modules that runs as both Unix user programs and Unix kernel processes. VINES supports MS-DOS, Windows, Macintosh, OS/2 and Unix clients, offers a full range of services for sharing printers and disks, and boasts what is arguably the most mature and tested global directory service, StreetTalk.

STREETTALK BASICS

To understand VINES security, one must have an appreciation of StreetTalk, a database that performs two critical enterprise network functions. It stores data about the entire network and provides the framework for security. Its strong and logical structure gives the security services a sound backbone for management and control.

StreetTalk coordinates network access and allows users to have a single network logon, allowing all the servers to work together. When users log on using DOS, Windows or OS/2, they're logging on to the entire network rather than on to a particular server. Macintoshes, in contrast, still have a server-oriented view of the network as they access VINES through AppleTalk File Protocol (AFP).

Each VINES server has its own StreetTalk service. When a VINES server joins an internetwork, its copy of StreetTalk informs all the other servers on the network about the groups and resources it owns. The other servers, in turn, list their groups and resources. The detailed authentication information of each object lives only on the server that owns the object.

Where VINES 5.5 falls short, however, is in its inability to replicate the authentication services. This means that when a particular server within an internetwork crashes, users on that server will not be able to log on. Until the server comes back on-line, that authentication data is unavailable.

See **VINES**, *page 25*

Firm leads pact with Unix storage wares release

BY CHRISTINE BURNS

New York

Software Partners/32, Inc. was one of many companies rolling out new network products for Unix environments at Unix Expo here last week.

UNIX EXPO

Software Partners/32's StorageCenter is a storage management product that enables managers to centrally control the backup of Unix workstations and servers, including IBM RISC System/6000s, Digital Equipment Corp. DECstation 5000s, Hewlett-Packard Co. HP 9000 and Sun Microsystems, Inc. Sun 4 and SPARCstations.

StorageCenter is built on Open Systems Interconnection standards and contains a portable, C-based application program interface that allows for integration into existing applications.

The product includes independent software modules for servers and networked storage facilities and can be used separately or integrated according to requirements. A remote administration module allows an administrator to control the other components from any node on the network.

The backup and restore module on the server lets a network manager back up and restore files, groups of files, directories or file systems on any networked Unix machine to any other machine or tape drive.

Using the hierarchical storage module, a network manager can define under what conditions stored data should be moved from expensive disk space to cheaper tape or optical units. A media management component sits on a backup unit and manages backup media and hardware by tracking where it is on the network and how often it is accessed.

The backup and restore module is available immediately for $5,595, including support for 10 clients and Exabyte Corp.'s EXB-10i tape library. The media manager component, which is also a server component, will be available in December, with the remaining modules shipping in the first quarter of next year.

Other companies introduced network management products, while still others rolled out wares that connect Unix boxes to Systems Network Architecture

See **Unix**, *page 27*

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LAN Adapter for Ethernet
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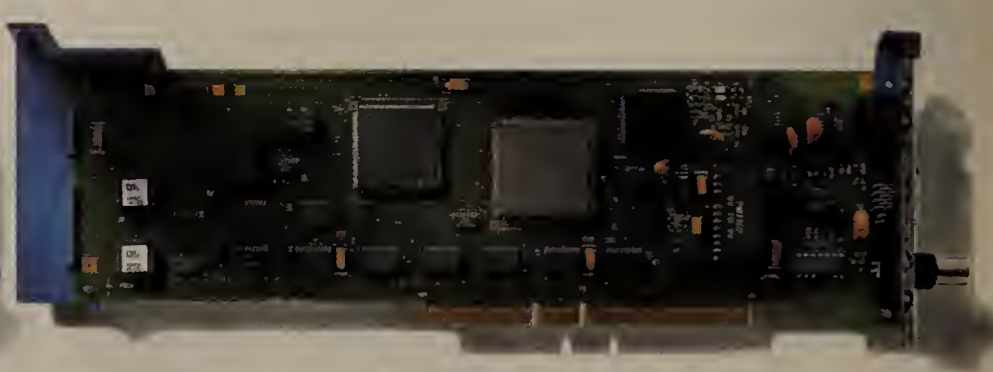

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VINES

Continued from page 22

Because StreetTalk services share information among VINES servers, users don't need to log on to each server individually to use resources. Instead, users may access resources from any of the servers on the network — provided that they have been granted the appropriate privileges.

StreetTalk also acts as the repository of information about users and services. Users may assign a name to every object in the internetwork system. Objects include users, printers, disk volumes, other organizations and gateways to remote systems. Objects are organized hierarchically and typically follow the structured naming format: item@group@organization.

There are five types of items: users; nicknames, which allow users to define "MGibbs" as a nickname for "Mark Gibbs@Consulting Group@Gibbs and Co."; services, such as file and print; lists for electronic mail distribution, access rights and lists of object administrators, called AdminLists; and groups, which are collections of items of any type that have a common element.

Each server has an AdminList object with the reserved name "AdminList@group@organization," where "group@organization" is the server's defaults that are specified during installation. As with all AdminLists, the names on the lists are the managers of the specified group and the objects in that group. Since this group owns all the objects on the server, the users in the AdminList are the server's supervisors.

Banyan has not announced any details of the next release of StreetTalk, but they said full fault tolerance for the service is on the agenda. Exactly what they will include is, as yet, unannounced. Banyan is also looking at moving toward the X.500 standard when the 1992 and 1993 specification efforts are complete.

USER CONTROL BASICS

User accounts are defined within StreetTalk. The logon authentication security settings — which determine where and when a user can log on — default to a standard VINES set unless changed. These default settings are not particularly restrictive and are appropriate only for very uncomplicated installations. By default, no restrictions are placed on logon times. In addition, user accounts are not given expiration dates, and passwords are not required to be changed periodically.

Even Banyan does not advise using the defaults. Although it would be too much to expect Banyan to define a default set that appeals to everyone, it would make sense for the company to develop a default set that is better suited for a greater number of sites.

If the default settings are not appropriate, the alternative is to assign users to groups and then define the security settings for the group or to define settings for users individually. There are nine settings that can be defined, including password and logon restrictions, as well as permission to modify the logon script (called a profile). User accounts can also be disabled.

Password control can be set to prevent users from changing their own passwords, require that passwords be of a minimum length (the maximum is 15 characters for DOS, Windows and OS/2, and eight for Macintosh) and enforce periodic changes in passwords. VINES has always used encrypted passwords for DOS, Windows and OS/2 clients. Password encryption for Macintosh users occurs only when the user logs on to VINES through StreetTalk, not when accessing AFP-based services, which is the native network support of the Macintosh operating system.

Logon restrictions can be used to limit group members' logons to certain times of the day, thus preventing users from logging on after hours. If users are detected on the network after hours, they can be prompted to log off or they can automatically be logged off the network.

NOS security features

	VINES 5.5	NetWare 4.0
Account control		
Minimum password length	✓	✓
Password aging	✓	✓
Account expiration	✓	✓
Physical location	✓	✓
Login time and day	✓	✓
Resource control		
File controls	✓	✓
Directory controls	✓	✓
Multiple rights views	✓	
User disk quotas		✓
Print services controls	✓	✓
Global directory services		
Comprehensive services control	✓	Incomplete
Integration with messaging	✓	*
Interserver security	✓	
Backward compatibility	✓	
Replication of authentication	*	✓
General		
C2 certification	*	*
On-the-fly file compression		✓
Data migration		✓
Auditing	✓	✓

*Planned for future release.
NOS = Network operating system
GRAPHIC BY SUSAN SLATER SOURCE: GIBBS & CO., VENTURA, CALIF.

Logon restrictions can also serve other useful functions. The number of times a user can log on under a specific user name can be limited, and users can be prevented from logging on at specific workstations on the network or from using certain client operating systems. Restrictions may also be used to prevent users from logging on from certain local-area network segments.

One noticeable user control feature, however, is missing — the ability to restrict disk space usage. In large networks, disk quotas for users can prevent "disk hogs" from causing problems. Without user disk quotas, space required for system operations, such as printer queues and swap areas, can be used up, resulting in disabled services or poor performance. In contrast, NetWare offers this feature, allowing disk quotas to be set on a user-by-user basis.

DATA ACCESS

Under VINES, access to data is controlled by Access Rights Lists (ARL). Each directory has two ARLs — one that specifies access rights for the directory and its subdirectories, and a second that specifies the default rights for new files. Each ARL, in turn, has two parts — a primary list and an extended list. Files, by contrast, have only one ARL that specifies access rights.

The primary list defines the access rights for three groups: the owner of the file or directory, the group to which the owner belongs and the rest of the world (this shows VINES' Unix roots). The extended list can contain as many as five entries, giving specific rights to individual users or lists of users, groups or organizations.

There are three VINES rights that apply to both files and directories — Control, which allows a work group manager to change the access rights of other users except themselves; Read and Write. The Control right implementation allows work group managers to exercise user control but does not enable them to access the data in the areas they manage. A fourth right, Execute, allows users to read and execute a file.

Directories also have a Search right that permits directory listing and a Delete right that permits the removal of files or directories when combined with Search.

Rights can also be considered from any one of three views — the VINES view, the Macintosh view and a special Unix view for developers. Each operating system has its own way of defining access to files.

Macintosh access, for instance, is defined differently from VINES rights. Views allow rights to be seen from the perspective of other operating systems and are an important tool for checking that users of one operating system are allocated the correct access levels when they share data with users on different operating systems.

Banyan's documentation explains the use of rights, ARLs, views, the mapping of VINES rights to Macintosh rights and inheritance rules, but hands-on experience is still required to understand the concepts and build a secure system.

FILE, DIRECTORY ATTRIBUTES

In any operating system environment, particularly within a shared network one, it is vital to be able to control what kinds of access are allowed to individual files and directories. These controls are called attributes. In NOSes, attributes are usually a superset of those offered by the client operating systems.

Under VINES, file attributes can be set in addition to the DOS attributes of Read Only, Hidden, System and Archive. These attributes are No Delete and No Rename, Sharing and Execute Only, which only permits users to run programs, not copy them. The VINES directory attributes are No Rename, Hidden, System and Archive.

The equivalent Macintosh attributes under VINES are Locked (Read Only), Invisible (Hidden), System (System), Backup Needed (Archive), MultiUser (Sharing) and Copy Protect (Execute Only). For the Macintosh, the directory attributes are Locked, Invisible, System and Backup Needed.

Again, like VINES rights, file and directory attributes are complex. Experience and planning are required to build sound security.

PRINTER SECURITY

As with most NOSes, printer security can be enforced. Three levels of access — Administrator, Operator and User — can be defined. Administrators can create, modify and delete print services within their group or on their server. The administrator can start and stop print queues, assign printers to specific queues and set up filters that control how jobs are handled.

Operators can cancel, hold, reprint and reschedule jobs in a print queue, change paper format, move jobs from one queue to another and change queue status.

Users, the bottom level of the printer security totem pole, can control only their own print jobs. This control includes rescheduling and changing which queue the job is in, as well as canceling, holding and reprinting the job.

INTERSERVER SECURITY

In a complex internetwork, controlling interserver access can be highly desirable. A powerful feature of VINES server security is its ability to restrict the type of access that exists between servers on an internetwork. The restrictions apply regardless of the interconnection type. This level can be left at the default of full access (all other user access rights still apply), mail-only or secure (no access) and can be set for connections to specific servers. Connections can even be password-protected.

That facility is unique to VINES. With the VINES system, the best strategy is to set the default access for each server to secure and then set the appropriate level of access for specific servers.

Another important NOS facility is auditing, a service that tracks events, such as user logon attempts, and service access, and records them for review and analysis. This allows the identification of security violation attempts and improper system usage. Like most of the other NOSes, VINES offers no real data analysis tools, making it difficult to identify critical events.

UNDER LOCK AND KEY

Banyan has chosen to use hardware "dongles" to prevent unauthorized use of its software and provide each server with a unique serial number. Each server has a dongle called a server key. Additional dongles are needed for software options, such as mail service, 3270 emulation and server-to-server connections.

The dongle is a hardware connector that attaches to the server's first parallel port and can have a printer attached to it. In a typical operation, the dongle is transparent. Any service using the port, such as a printer, is not affected. When new services are added to a server, additional dongles must be connected to the original dongle — they can be daisy-chained — in order to update the original dongle's server key. Once the update is completed, the new dongle no longer needs to be connected and can be returned to Banyan for a credit.

It's surprising that Banyan still uses dongles because they can potentially cause problems. Although the devices are usually highly reliable, they can be lost, damaged or stolen, presenting an unnecessary risk. They also add management complexity to an already complex system. None of the other high-end NOSes use dongles. Instead, they enforce licensing through the software.

BOTTOM LINE

Banyan VINES is an outstanding NOS that will impose a fairly steep learning curve on users. Nevertheless, it has the most mature, stable and proven global directory service on the market and an array of security features that make it a sound choice for enterprise networking.

Once Banyan adds important features, such as replication of user authentication data and disk quota enforcement, and receives C2 certification, VINES will have truly industrial-strength enterprise security.

Gibbs is a writer and consultant based in Ventura, Calif. He holds a position as technology analyst with the National Computer Security Association (800) 488-4595. He can be contacted at (805) 647-2307 or through CompuServe (75600,1002), Novell's nHub (mgibbs@gyre) or on the Internet (mgibbs@rain.org). His books, *The Absolute Beginner's Guide to Networking* and *Navigating the Internet* (both from Sams Publishing) are now available.

NET RESULTS

by Mark Gibbs

Many hands make nets work

I just received the coolest device from Oregon Scientific. It's a microprocessor-based, filofax-sized, name and address database device called Axxess. Axxess has a touch screen and connectors for a phone line and a handset, as well as a port to connect a printer or computer.

What has this got to do with networking? Axxess got me thinking. Here, for a few hundred bucks, is a device that takes a load off my computer. Rather than relying on the computer to be available for finding, dialing and logging calls — which it often isn't, having crashed or being tied up with something vitally important to the future of humanity such as playing Maxis' SimCity — Axxess takes over.

Back in those heady years after the PC was launched, pundits were saying we'd find microprocessors everywhere. To an extent, they were right. Today, it's hard to find a kettle that isn't microprocessor-assisted.

But in the PC industry, it's still pretty much one user, one processor. This makes little sense when microprocessors are relatively in- expensive. For example, an Intel 386DX 50 motherboard costs about $200 and one megabyte of RAM about $65. The actual microprocessor — the thing that does the work — costs around $40.

Why does the PC only have one? Even with the additional electronics to integrate another processor, it costs less to add horsepower than to add a megabyte to the memory!

The main reason we don't have multiprocessor PCs is that the vast majority of desktop operating systems aren't built to use more than one processor. Pathetic, isn't it? All this power and we don't have any way of using it.

What about our network operating systems? There are several that support multiprocessing but usually at a premium cost on platforms that are pretty pricey. Interestingly, Microsoft Corp.'s Windows NT Advanced Server supports symmetric multiprocessing for up to four processors out of the box at no extra cost — nice positioning!

But even with desktop and NOSes that support multiple microprocessors, you're putting all your digital eggs in one basket. If that system has a hardware failure or simply abends, crashes or otherwise grinds to a halt, you lose all the services on that PC. For a net server, a crash could affect thousands of users.

When Novell, Inc. offered Runtime NetWare it looked like a golden opportunity for adding horsepower to NetWare systems in a cost-effective way. This product is essentially a single-user version of NetWare 3.11 that lets you run NetWare Loadable Modules (NLM) on a PC other than the file server. Now we're talking. If you run out of processor power on the server or don't want to put everything on a single-server, this is a great solution. But NetWare Runtime has only been licensed to OEMs and not many have taken it up.

One of the few vendors to use Runtime NetWare is NetWorth, Inc.,which produced a hardware module called the NetWare Application Engine that's essentially a 486-based PC that plugs into the Series 4000 Hub. Combined with Runtime NetWare, this subsystem allows you to run NLM-based services in the hub.

Viewed as a PC, it's expensive: $4,995 including NetWare Runtime, $3,995 without. But it does boast solid engineering and high-bandwidth access to the network because it's on the hub backplane.

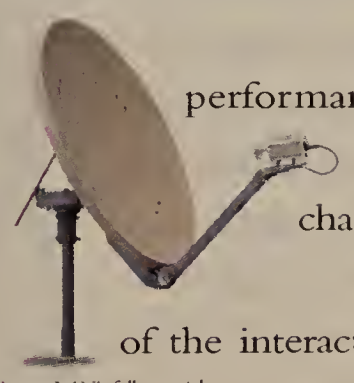
This is a sensible way to extend the computing power of your network services. Throw more simple microprocessors at the problem — don't buy faster, more exotic configurations. The trend to turn servers into mainframes by loading them up with every service we can find and putting them on expensive, complex platforms is recapitulating to an environment we all agreed went against common sense.

Let's see more hardware and less software. Let's see more specialized processors and services implemented as independent network hardware units and make what runs on those boxes as simple as possible. Then we'll have more time and horsepower to play SimCity.

➞ Mark Gibbs, a consultant and writer in Ventura, Calif., can be reached via E-mail on CompuServe as [75600,1002] or on the Internet as mgibbs@rain.org.

If you still think landlines are the best way to link up to your LANs, then you haven't talked to Hughes Network Systems. Today, top organizations around the world have turned to Hughes, the leader in VSAT satellite commu-

nications, to provide an affordable, high-quality source of LAN interconnection for their business networks. They've found that a Hughes VSAT can offer high performance and LAN capability, with added flexibility for system changes and expansions. And only Hughes, provider of over 70% of the interactive VSAT installations in the U.S., offers service for both Ethernet and Token Ring configurations. Why be LANlocked when you can take advantage of improved communications at a comparable cost? For more information, call 301-428-5500, ext. 3751.



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Interphase to ease server load with net coprocessor

BY SKIP MACASKILL

Dallas

Interphase Corp. is expected to announce this week a network interface card for SBus-based servers that frees up server CPU cycles by assuming protocol processing tasks.

The Interphase 4627 Network CoProcessor, an intelligent dual-port Ethernet adapter, can triple or quadruple server capacity, allowing the device to handle more applications, workstations, Ethernet segments and Network File System requests, according to Greg Iverson, vice president of marketing.

Interphase will announce that it has been selected as a hardware provider for HP's Interface Program.

"Typically, the Ethernet controller only handles the physical and data link layers of the stack, with the host CPU picking up the rest," he said. "The CoProcessor lets the user reduce the per-seat cost of his client/server network as well as extend the life of the server."

The card is powered by a 38-MHz 68030 microprocessor from Motorola, Inc. and provides two 10Base-T Ethernet ports for each single SBus slot. The 32-bit adapter supports software drivers for Solaris 2.X. Available in the fourth quarter, the 4627 Network CoProcessor costs $5,950.

In conjunction with the CoProcessor release, Interphase will also announce that it has been selected as a hardware provider for Hewlett-Packard Co.'s Interface Program, which is designed to help vendors develop industry-standard products for HP workstations.

As part of that agreement, Interphase will offer the 4811 SeaHawk net controller, an Extended Industry Standard Architecture-based Fiber Distributed Data Interface adapter that comes with an HP-UX driver to support HP's Apollo 9000 Series 700 workstations.

The single- or dual-attached SeaHawk provides 100M bit/sec of FDDI connectivity over fiber-optic cable or copper wiring and has been benchmarked at over 70M bit/sec throughput on the Series 700 workstation by HP. Available now, the 4811 costs $1,795 in single units.

The product will also be available in Power Kits, which are specially priced packages from Interphase for Sun Microsystems, Inc. and HP users that include Interphase's M800 FDDI concentrator and four to eight adapters complete with drivers.

✆Interphase: (214) 919-9000.

Unix

Continued from page 25

components and improve electronic messaging services for Unix users.

Delta Microsystems, Inc. announced a new version of its network backup management product to run on HP 9000 machines. BudTool 4.2 offers a Windows configuration tool, monitoring of new machines on the net and split image support that automatically continues a backup request on a second tape if interrupted by a device running out of tape. BudTool 4.2 is also available on SunOS, Solaris and Auspex platforms, while support for RS/6000 machines is expected in October.

SoftLinx, Inc. released a new version of its Replix Unix server-based facsimile management software that lets personal computer users running Windows send and receive faxes through the Unix server. New features in Replix 2.0 include support of direct-inward dialing, automatic printing of incoming faxes and the ability to fax multiple files at once.

Systems Strategies, Inc. has revamped its Express Unix-to-SNA software connectivity product line to support data-streaming for fast I/O data rates and added a Motif graphical user interface. In addition to standard 3270 terminal emulation, the firm has added 3179-G emulation for mainframe connectivity and 5250 emulation for data transfer ties to Application System/400 minicomputers. It also allows a Unix workstation to serve as an end node on an IBM Advanced Peer-to-Peer Network.

Z-Code Software Corp. released a new version of its Z-Mail for Unix Systems electronic messaging software with several enhancements. Z-Mail Version 3.0 supports Motif Version 1.2, a HELP program that guides users through the electronic mail process, support for languages such as Japanese, French and German, and compliance with the proposed Internet standard message format, Multipurpose Internet Mail Extensions (MIME).

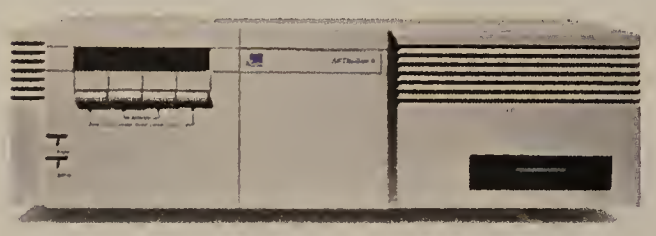
UniPress Software, Inc. announced Mail-It 2.0, which provides a Windows interface to Unix/Internet mail. This PC-to-Unix E-mail product includes MIME support that lets users mail large binary files between Unix workstations and networked PCs. Z

Comments

If you have a comment on this or any other article, drop us a fax at (508) 820-3467 or call (800) 622-1108, Ext. 487.

We came. We s

Of course, we're not normally ones to boast, but in this case, it's too hard to resist. Recently, *Communications Week* tested several internetworking devices in multi-protocol environments. 3Com's NETBuilder II® earned a perfect score in every single test scenario. The first perfect overall score recorded. Anything they could dish out, this router could take.



Surprised? We weren't. After all, NETBuilder II was designed to be the most powerful, flexible router made.

So powerful, its advanced RISC processor and high-speed bus make it one of the industry's top performers. At a price that's almost a third less than our biggest competitor.

And so flexible, it can support Novell's IPX, AppleTalk, IBM

First Perfect Ove

Cisco device takes a licking, but 3Com bridge-router keeps on ticki

By EDWIN E. MIER AND CHRIS GIULIANO

When bridge-routers from Cisco Systems Inc. and 3Com Corp. were evaluated for this installment of *Communications Week*'s mixed-LAN test program, it was 3Com's NetBuilder II that carried home the awards.

In fact, the NetBuilder II is the only bridge-router among the six tested to date in our series to command a perfect score for all test scenarios.

The NetBuilder II successfully handled the worst traffic scenarios we could throw at it, without skipping a bit.

That performance, coupled with a price tag that is considerably lower than many oth-

er market leaders', 3Com's bridge-router an lent choice for users in necting token-ring and E LANs.

In performance, Cisco bridge-router clearly l hind the 3Com devic MGS—a product that older than the vendor's 7000 series bridge-rou still marketed by Cis tested both at a user si our labs, despite the decision not to particip test program.

The Cisco bridge-r most adept at process net and Novell Inc. Int Packet Exchange traff handle the maximum DEC'net traffic load ir of the test scenarios

Testi

PRODUCT COMMUNICATIONSWEEK TESTING

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Conners beefs up storage line, restructures company

BY CARYN GILLOOLY

San Jose, Calif.

Conner Peripherals, Inc., based here, has restructured and rolled out a barrage of products focused on the backup and storage market.

George Rae, executive vice president of Conner's Storage Systems Group, said his unit, under the reorganization, will bring products together from the firm's Tape Products, Disk Products and Software Products Groups to form backup and storage subsystems.

The Storage Systems Group has brought out a NetWare 4.0 version of its NetWorker software as well as a Conner HSM hierarchical storage management product.

NetWorker lets administrators perform automated network backup at any time. Because of NetWare 4.0's network-centric makeup, with NetWorker, the administrator can now back up the entire network rather than specifying backups server-by-server, as was the case with the NetWare 3.11 version.

Conner HSM is a hardware/software system that gives users mainframe-type storage alternatives for local-area networks.

HSM is a technology under which data is automatically migrated from more expensive hard disks to less expensive tape and magneto-optical storage devices. HSM systems can also automatically retrieve the data, keeping all network data on-line and accessible at any time without taking up hard-disk space.

Also in the performance-user category but offered through the company's Software Products Group is Conner Backup Exec for Windows and Conner Backup Exec for Windows NT. These are software packages that reside on either a Windows client, Windows NT client or Windows NT Advanced Server to provide automatic backup capabilities for these systems.

LOW-END DEVICES

The Storage Systems Group also brought out products for the lower end of the market.

"In an entry-level system, the driving factors are price, price and price," Rae said. "For the value market customers using, for example, [Artisoft, Inc.'s] LANtastic or [Novell, Inc.'s] NetWare Lite, price and capacity are the primary factors, and performance is not critical."

In these two areas, the Storage Systems Group is offering complete turnkey systems that include the company's Disk-Stor disk drive and Tape-Stor tape minicartridges.

NetWorker is available now and is priced from $750 to $7,500. HSM is also available now for $7,500. Conner Backup Exec for Windows and Windows NT are available now for $149 and $349, respectively. Disk-Stor pricing starts at $249, and Tape-Stor pricing starts at $179. Both are available now.

✆Conner: (408) 456-4500.

E-net

Continued from page 22

With fast bridging, which is done completely in hardware, the switch begins to process the address and decide what route the packet will travel while the entire frame is being received. As soon as the packet is received, it is switched to its destination.

"Fast bridging gives you the speed of cut-through and compliance to the IEEE 802.1D bridging standard, thereby reducing delays and localizing bad packets to individual segments," said David Delaney, director of product development at Plaintree.

STORE-AND-FORWARD

Because a packet must change speeds in a typical switching environment as it is routed — a user on a dedicated 10M bit/sec pipe accessing a server cluster sitting on an FDDI ring, for example — some level of store-and-forward switching is required, he added.

"Since even cut-through switching must use store-and-forward technology if a speed change is required, we decided to base our switching scheme around that senario," Delaney said. "And by sticking to the IEEE standard, the switch behaves in a way familiar to the net manager, which will make it easier to manage."

The WaveSwitch 100 provides 16 ports of dedicated Ethernet that can be connected to a single desktop device, a shared local-area network or another WaveSwitch. The hub also offers as many as two high-speed interfaces, which can be either FDDI or Plaintree's proprietary 100M bit/sec Ethernet technology, dubbed WaveBus, which uses fiber-optic links.

Asynchronous Transfer Mode (ATM) and standards-based 100M bit/sec Ethernet interfaces will be added in 1994.

Available in December, the WaveSwitch 100 will cost $7,250 for the 16-port configuration, $3,200 for each FDDI port and $1,450 for each WaveBus connection.

The WaveSwitch 400 is an eight-slot switching hub that can support seven interface modules and a single net management module. The device can be outfitted with seven 16-port modules of 10Base-T, providing 112 ports of dedicated Ethernet via RJ-45 connectors.

Other modules available include a four-port 10Base-T/AUI module with an attachment unit interface and RJ-45 connection available for each port; a Plaintree Fast Ethernet module with four WaveBus fiber-optic connections; and an FDDI module with two single-attached or one dual-attached FDDI connections.

COMING ATTRACTIONS

Modules available in 1994 will include a 12-port 10Base-FL module, an FDDI-over-copper module that supports four single-attached connections and an ATM module.

Available in December, the chassis and management module will cost $9,125. Each 16-port Ethernet module costs $5,360, while the FDDI modules are priced at $3,350 per port. The WaveBus modules cost $1,200 per port.

✆Plaintree: (617) 239-8077.

aw. We routed.

l Score Earned

3COM'S PERFORMANCE IN A MIXED-LAN ENVIRONMENT

Traffic streams from an Ethernet and a token-ring LAN were sent to a 3Com NetBuilder II bridge-router simultaneously. To reflect real-world conditions, packet sizes and the number of nodes on both LANs were varied. The traffic load was increased in 10 percent increments, up to the maximum that can be exchanged between the LANs in each scenario. The figures in the grids represent (as percentages of the maximum possible) the levels at which the device processed bidirectional traffic before it began to drop packets. Results are given for each routed protocol tested and for transparent bridging.

AppleTalk

No. of nodes	Packet size in bytes				
	Ethernet to token-ring				
Ethernet/token-ring	64	128	512	128	64
100/1	100%	100%	100%	100%	100%
50/50	100%	100%	100%	100%	100%
1/100	100%	100%	100%	100%	100%
100/100	100%	100%	100%	100%	100%
	512	512	128	128	64
	Token-ring to Ethernet				

DECnet

No. of nodes	Packet size in bytes				
	Ethernet to token-ring				
Ethernet/token-ring	64	512	1,500	128	64
100/1	100%	100%	100%	100%	100%
50/50	100%	100%	100%	100%	100%
1/100	100%	100%	100%	100%	100%
100/100	100%	100%	100%	100%	100%
	1,500	512	64	128	64
	Token-ring to Ethernet				

No. of nodes	Packet size in bytes				
	Ethernet to token-ring				
Ethernet/token-ring	64	512	1,500	128	64

NetBIOS/NetBEUI, Banyan VINES, DECnet, XNS, OSI, and TCP/IP protocols. Not to mention any LAN or WAN media, including FDDI and other high-speed media that come along.

NETBuilder's modular design means interface, media, topology, and technology changes can be made in no time. Plus, hot-swappable modules make network problems easy to repair, with absolutely no interruption in service. In fact, meantime board replacement is less than five minutes. Want to know more about NETBuilder II? Give us a call at

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We'll send you a copy of our perfect test results, and show you the most powerful way to conquer your internetworking needs.

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Tigon launches support services for Octel systems

BY BOB WALLACE

Dallas

International voice mail service bureau Tigon last week announced a series of support services for firms that do not have the resources to maintain and manage voice mail systems from Tigon's parent company, Octel Communications Corp.

Tigon's new Management Services include Project Management, Voice Processing Program services, Operations Management and System Management.

"We've put together a powerful suite of services designed to cover all aspects of voice mail systems support," said Bruce Simpson, president of Tigon. "We're targeting companies that are constantly changing but don't have the time or staff to keep up."

SIMPSON

Tigon's Project Management services will be especially useful to companies that need to move offices, Simpson said. Tigon will schedule the system move, move the switch and work with carriers to make sure there are local and long-distance lines to the system. "Our goal is to keep downtime to a minimum," he said.

With Voice Processing Program services, Tigon provides end-user education materials and training, and will also help develop marketing programs designed to build internal use of voice mail systems.

Operations Management covers Systems Monitoring, Access Monitoring and Configuration Management.

"Our goal is to keep downtime to a minimum," said Bruce Simpson, president of Tigon.

With System Monitoring, Tigon installs a 56K bit/sec private line linking the user's Octel voice mail system to Tigon's control center here. Technicians can then constantly monitor the health of the system. Tigon will also offer a dial-up monitoring service, whereby technicians poll the Octel system six to eight times a day, Simpson said.

Tigon also provides Access Monitoring, whereby its staff periodically dials customer-provided voice mail access numbers to make sure they are operating properly.

With Configuration Management, Tigon helps users optimize Octel voice mail systems for performance and cost. The company uses mathematical techniques to to decide how many ports and trunks each system should have.

Tigon offers System Management for companies that do not have the time or manpower to handle large numbers of administrative changes to the system. The service provider will administer moves, adds and changes after receiving faxes from Octel users. "Although it's common for large users to take two weeks to process an order, we guarantee a one-day interval," Simpson said.

Many of the services are available now and are priced on a customer-specific basis.

✆Tigon: (214) 733-2700.

PacBell, others in California brace for local toll competition

Long-distance carriers to enter market Jan. 1.

BY BILL BURCH

San Francisco

On Jan. 1, Pacific Bell, GTE Corp. and other California local exchange carriers will face competition in the state's $3 billion local toll market, thanks to a decision this month by the California Public Utilities Commission.

With that opening, the commission plans to cut local exchange carriers' local toll rates by 40% to 60%, ending the cross-subsidization of such services as residential basic rate access. Basic rates, meanwhile, will increase in an effort to neutralize the overall effect on phone company revenue.

That spells good news for business users as it will mean lower rates for calls over 12 miles that remain within a service area or local access and transport area (see graphic, page 32).

Additionally, the commission is expected to grant an increase in private-line rates that amounts to much less than what Pacific Bell had requested.

AT&T, MCI Corp., and Sprint Corp. have all filed to provide local toll service in the state.

The commission's order was expected Sept. 24. Pacific Bell expects cuts to its toll rates of around 60%; GTE predicted its rates would be down 40%.

California will join more than 40 other states with local toll competition. The size of the California market, however, makes it exceptionally tempting to long-distance carriers.

With roughly 18 million telephone users in 11 LATAs, California is the largest and most populous state so far to allow local toll competition. GTE, Pacific Bell and other smaller telephone companies earn roughly $9 billion providing local services to the state.

See **California**, *page 32*

TELECOMMUNICATIONS

Federal agencies big spenders on telecom

BY ELLEN MESSMER

Washington, D.C.

Federal information technology spending will reach $24.4 billion this year, with $7 billion of that going into telecommunications, according to a report released last week.

The Electronics Industry Association (EIA), in its five-year forecast on the federal government's computer and communications purchasing plans, predicted a steady increase in telecommunications spending (see chart, page this page), with newer technologies such as wireless packet data and Asynchronous Transfer Mode (ATM) expected to make inroads into the government market.

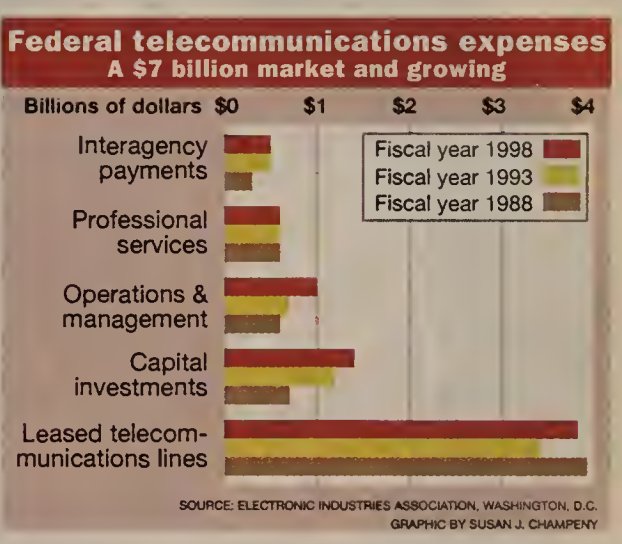
In a survey of agency policy analysts and information resource officials at 40 civilian and defense agencies, the EIA learned details of anticipated buys, such as the $1 billion Defense Switched Services procurement and the even bigger Inter-City Telecommunications System (ICTS) — the replacement for Federal Telecommunications System (FTS) 2000 — going out for bid in 1995.

But the EIA's interviews with agency telecommunications managers revealed many initiatives not as widely known, such as the Department of the Treasury's interest in wireless packet data networks, expected to lead to a $1 billion purchase of mobile data equipment and services in the next few years.

"In the wireless area, the Treasury Department is working with the Justice Department and the law enforcement community to try and determine digital voice and data requirements," said Guy Copeland, director of the network engineering center at Computer Sciences Corp., one of several EIA members that worked on the five-year forecast.

The Treasury Department, which has an extensive private radio system for voice, will meet this week with the Federal Wireless Users Forum at the National Institute of Standards and Technology to discuss tech-

See **Federal**, *page 32*



BRIEFS

LCI International, a long-haul carrier based in Dublin, Ohio, last week announced the formation of a new unit that will enable the carrier to better address the increasing demand for data communications services.

The new organization is called Data Services Group and will consolidate LCI's current data development and marketing resources to provide users with the service and support necessary to meet their data networking needs.

Data Services Group will be under the direction of Scott Booth, LCI's senior manager of data services marketing. LCI offers a wide variety of data offerings, including private-line, switched digital and frame relay services.

The carrier is expected to roll out X.25 service in the fourth quarter of 1994 and said it will soon announce LCI's Asynchronous Transfer Mode strategy.

Sprint Corp. last week announced a three-year, $12 million contract to provide 1+ direct dial, 800 and operator-assisted service to Travelodge's 500 hotels and reservations centers. Travelodge is a division of Forte Hotels, Inc.

The spokesman said the chain selected Sprint largely because it had the lowest rates and the company "wanted a partner who was going to help us with our needs, not only at reservation centers, but at individual hotels. Sprint was far and away the winner in its knowledge of our industry and ability to serve hotel owners and managers." The carrier has a separate business unit dedicated solely to the hospitality industry.

AT&T and Century 21 Real Estate Corp. have announced a new toll-free office locator service that simplifies the process of finding real estate sales agents and brokers around the country.

By dialing 1-800-4-HOUSES and entering the zip code of the area of interest, a caller will be routed automatically to a Century 21 office in that region. The offering is made possible by combining AT&T's InfoWorx Service, a network-based voice response system, with AT&T 800 service.

See **Briefs**, *page 32*

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Scientific Atlanta

Kinko's to give retail videoconferencing a try

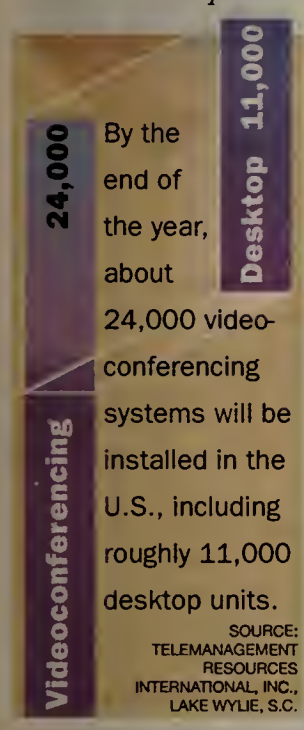
BY BILL BURCH

Washington, D.C.

Videoconferencing will hit the road in January when the copy center chain Kinko's Service Corp. begins offering a service targeted at traveling business executives and priced at less than $150 per hour.

By April, Kinko's plans to have videoconferencing booths in at least 100 of its roughly 600 copy centers. The booths will be tied together via Sprint Corp.'s videoconferencing net, giving users access to thousands of videoconferencing sites around the globe.

At the centers, Kinko's plans to install two types of videoconferencing systems from PictureTel Corp. of Danvers, Mass. The PictureTel System 1000 will support traditional videoconferencing, while the PictureTel Live PCS 100 desktop system will split a computer screen for simultaneous image transfer and file access, letting both parties look at and work on the same computer screen. The booths will also be equipped with phones, scanners and facsimile machines.



By the end of the year, about 24,000 videoconferencing systems will be installed in the U.S., including roughly 11,000 desktop units.

SOURCE: TELEMANAGEMENT RESOURCES INTERNATIONAL, INC., LAKE WYLIE, S.C.

At $150 per hour, Kinko's will offer a substantial price advantage over current videoconferencing service companies, which rent rooms for around $250 per hour. When it comes to marketing the service, videoconferencing will also fit nicely with Kinko's "mobile office" pitch, said Scott Douglas, managing director of Telemanagement Resources International, Inc., a videoconferencing consulting firm in Lake Wylie, S.C.

During the past year, videoconferencing has seen phenomenal growth, with sales jumping 100%, Douglas said (see graphic, this page). Three to four years ago, only the country's top 50 companies could afford videoconferencing, but the technology has now spread to the top 1,000 companies, thanks to less-expensive desktop units, Douglas said.

That widening user base can be partly attributed to rapidly declining equipment costs. The average system price was $7,000 last year, dropped to $5,000 this year, and should be down to $3,400 next year, Douglas said.

By 1997, a videoconferencing system should be below $1,000, according to Douglas. At that point, Douglas said he expects users will begin ordering videoconferencing as an option for personal computers, just as customers today order a modem for data connectivity.

At Kinko's, the company is launching the service on the basis of Chairman Paul Orfalea's gut feeling, who said the company has not done any market research to see if the idea will fly. Orfalea has pledged to install booths in the 100 centers he controls and said he is willing to twist arms to get owners of other Kinko's outlets to follow suit. However, the final decision on whether to join the network remains with individual outlet owners. Ken Hightower, a Kinko's owner in the Washington, D.C., area, said he is excited about the service and plans to install a booth in an 8,200-sq.-ft. store in Rockville, Md.

To inspire that same enthusiasm among users, Kinko's will charge only $20 per half-hour during the first three months of service. "If you drop the price low enough, people will figure out how to use it," Orfalea said. Through the Sprint net, Kinko's users will be able to reach 3,000 public and private videoconferencing rooms in 38 countries. The Sprint network can also be interconnected with other carriers' nets, and Sprint can handle protocol conversion to tie into nets running proprietary standards. The U.S. currently has approximately 20,000 installed videoconferencing systems.

Sprint will run T-1 lines into Kinko's outlets, which will then be broken down into slower speed lines via channel banks. Kinko's will start out using 384K bit/sec lines for full-motion video. Later, the company plans to try 112K bit/sec, which provides fairly good video for stationary subjects, according to Tina Mayland, director of sales and marketing at Sprint Video Group, a division of Sprint Corp. The desktop unit with its smaller image will eventually be migrated solely to 112K bit/sec.

Kinko's declined to reveal how much it plans to spend on the network or give revenue projections. Installation expenses promise to be substantial. Sprint generally charges $1,500 to install a videoconferencing system at a customer site. As for the equipment, PictureTel charges $5,995 for the desktop unit and $19,900 for the System 1000.

GRAPHIC BY SUSAN J. CHAMPENY SOURCE: PACIFIC BELL, SAN FRANCISCO

California

Continued from page 30

To get access to an alternate provider, users will dial a five-digit carrier access code, as is currently done for long-distance carriers.

If a customer does not use an access code, the call will default to the local phone company for transmission.

To give consumers better choices on carriers, the commission is considering whether to allow customers to presubscribe to a local toll carrier and will take up that question in hearings beginning Jan. 14. Pacific Bell and GTE have both said presubscription for local toll calling can be done on their networks.

Long-distance carriers would benefit from presubscription, as it would allow users to select them as their default carriers for local toll traffic. AT&T said it strongly favors presubscription and plans to launch services statewide on Jan. 1, as does MCI.

"We're looking forward to the opening of the local access and transport areas on Jan. 1," said Cindy Andreotti, MCI's regional vice president for western national accounts. "We intend to be fully competitive in all categories, be it business or residential traffic, in all markets throughout California."

Sprint also said it would pursue local toll business but is still working on its rate structure.

Now that a large segment of its core business will be open to competition, Pacific Bell plans to push all the harder for the right to offer long-distance services, which the carrier is currently barred from doing by the Consent Decree.

The company will also offer large users package deals to keep them on its network, according to Mike Miller, the company's vice president of competitive readiness.

Pacific Bell wants to offer graduated discounts, giving bigger breaks for more usage, a plan that GTE said it would also like to try. Also, the company plans to try some innovations in Custom Calling, Centrex and other services, Miller said.

For its Centrex service, the carrier is asking the commission for pricing flexibility. Pacific Bell has proposed offering lower rates to users that are less than three miles from a central office, as well as cutting deals for customers that are willing to sign up for longer contracts.

Even without such deals, local daytime toll calls for business and residential users alike will fall 40% to 60%, while evening and night rates will decline up to 80%.

However, the basic service rate for businesses will rise, with Pacific Bell increasing its measured service rate for businesses from $8.35 to $10.86.

The big winners under the new plan will be businesses that make heavy use of local toll calls. For the company that makes only an average number of toll calls, the commission estimates bills will drop by 10%. Businesses that make only local calls will have slightly higher bills.

Federal

Continued from page 30

nology choices.

"The goal would be to develop a national enforcement/public safety network," said Jim Flysik, director of telecommunications management at the Treasury Department.

Users, which could include state and local law enforcement officers in addition to federal agencies, should be able to save money through this approach, he added.

Cell-based ATM is also getting federal users' attention, although it is still viewed as a utopian technology. But ATM, along with security, were the subjects federal users most mentioned in the survey, EIA members said.

The EIA survey also found that managers perceive a lack of government staff members who are technically qualified in both telecommunications and data networking.

With data needs increasing 20% each year, the government's need for bandwidth seems almost insatiable.

"T-1 circuits are being gobbled up as quickly as they're brought on-line," said Charles Alvord, director of civilian agency programs at Boeing Computer Services. This quest for bandwidth stems from the continuing push to interconnect dispersed local-area networks in a wide-area link, the EIA study concludes.

BRIEFS

Continued from page 30

If the caller is using a rotary-dial phone, the call will be routed automatically to a program administrator at Century 21 headquarters.

Nynex Corp. has awarded **Northern Telecom, Inc.** a five-year, $1 billion contract to provide switches that will enable the local carrier to attain its goal of having a fully digital network by 1998. Nynex will install Northern Telecom's S/DMS SuperNode digital switching system to replace analog switches throughout its network.

AT&T has won a $15.5 million multiyear contract to provide long-distance services to Reynolds Metals Co., an international aluminum and consumer products manufacturer in Richmond, Va.

Under the agreement, AT&T will provide 100 Megacom 800 and 800 Readyline lines for customer service applications, a 400-site Software-Defined Network and Accunet Digital Data Services for the firm's global data network.

Citing increased competition in the local loop, **Southwestern Bell Corp.** has asked the Federal Communications Commission for permission to sell local access lines under customer-specific arrangements rather than at tariffed rates. Southwestern Bell expects the FCC to issue a ruling on the filing in the coming weeks.

Outages on the nation's phone nets were down slightly in the second quarter, said the **Exchange Carriers Standards Association,** which reported 41 outages — a number it described as within reasonable limits. To be tallied, a net outage must last 30 minutes or more and affect more than 30,000 people. The group said the nation's nets "are in a stable state and continue to provide a high level of reliability."

Cylink Corp. said its T-1 Digital Encryption Standard encryption unit, the CIDEC-HSi, has met compatibility standards for use with AT&T's Accunet T-1 and Extended Superframe Format services, following a test conducted at AT&T's Holmdel, N.J., test facility.

Sprint Corp. has announced cooperative marketing deals with six vendors that will let it provide turnkey call center systems. Sprint will work with IBM, Rockwell International Corp./Switching Systems Division, Tandem Computers, Inc., Early Cloud and Co., Brock Control Systems, Inc. and Call Center Enterprises.

by David Rohde

Some Sprint, MCI users get all the breaks

Some MCI Communications Corp. and Sprint Corp. private-line users are feeling lucky today. Although the two carriers just added private lines to the list of services subject to price hikes, these users fall into usage categories where volume discounts have been liberalized and the price hike is cushioned...or even reversed.

But other MCI and Sprint users will have to accept the rate hikes consoled only by the knowledge that they still pay less than they would with AT&T.

Inspired by AT&T's big Aug. 1 price increases, MCI and Sprint first bumped up rates for switched services, then issued new private-line rates effective Sept. 1. These private-line rates for the No. 2 and No. 3 carriers remain very competitive with each other.

Consider the monthly charges for a 500-mile T-1 interoffice channel. Before Sept. 1, MCI charged $3,850 while Sprint charged $3,825 — a $25 difference. Now MCI charges $4,010 and Sprint $3,980 — a $30 difference. That extra $5 earns MCI the victory on the percentage increase: 4.2% vs. Sprint's 4.1%. But both of them stay comfortably below AT&T's post-Aug. 1 charge of $4,425 for the same 500-mile link.

For voice-grade interoffice channels, 500 miles now runs you $399 per month with MCI and a smidgen higher — exactly $402.72 — with Sprint. AT&T's cost is $466.

For T-3 channels, both MCI and Sprint formerly charged $37,400 per month. Sprint hiked its charge 4.3% to $39,000, and MCI went to $38,996. AT&T: $40,100 per month.

The more fortunate MCI users are those with term commitments who have monthly usage of $2,000 to $10,000 and Sprint users with term commitments who have monthly usage of either $5,000 to $10,000 or $75,000 to $100,000. Here's why.

For MCI users between $2,000 and $10,000, it's a simple matter — their percentage discounts were made more generous. For example, for fractional T-1 service, the two-year term discount rose from 9% to 16% for those whose usage is between $2,000 and $5,000.

Sprint's case is more complicated. Its T-1 volume pricing plan for term customers doesn't simply tote up usage and knock off a percentage. First, like MCI, Sprint asks you figure out your usage and then go to a table listing usage steps such as $10,000, $20,000, $35,000 and so on. But on this table, each usage level comes with a new, discounted pricing formula — including fixed and per-mile monthly charges — under which you recalculate your charges. The result is what you actually pay.

Before Sept. 1, the first volume pricing plan usage step was $10,000. Now Sprint has added a $5,000 usage step. For a one-year commitment, T-1 users at this step recalculate their charges at $1,820.57 fixed plus $2.66 per mile.

In addition, there used to be no usage step between $50,000 and $100,000. Now there's a usage step at $75,000 that, despite the rate hikes, features slightly lower rates than the old $50,000 step. Users in this category could actually see a slight rate drop if they hit the numbers just right.

These changes are chronicled in Sprint's Tariff #7 with the Federal Communications Commission. If you have a copy, you might notice the carrier made a little boo-boo. Although it changed the volume pricing plan rate table to start with a $5,000 usage level, the services description still declares: "If the initial calculation is less than $10,000, the intercity circuit charges will be billed at the base plan rates."

In other words, no discount between $5,000 and $10,000. This is a mistake — a not uncommon occurrence in tariff land — and certainly will be corrected soon with a revised tariff page.

Rohde is associate publisher of the Center for Communications Management Information in Rockville, Md., a provider of rate and tariffinformation. He can be reached at (301) 816-8950, Ext. 292.

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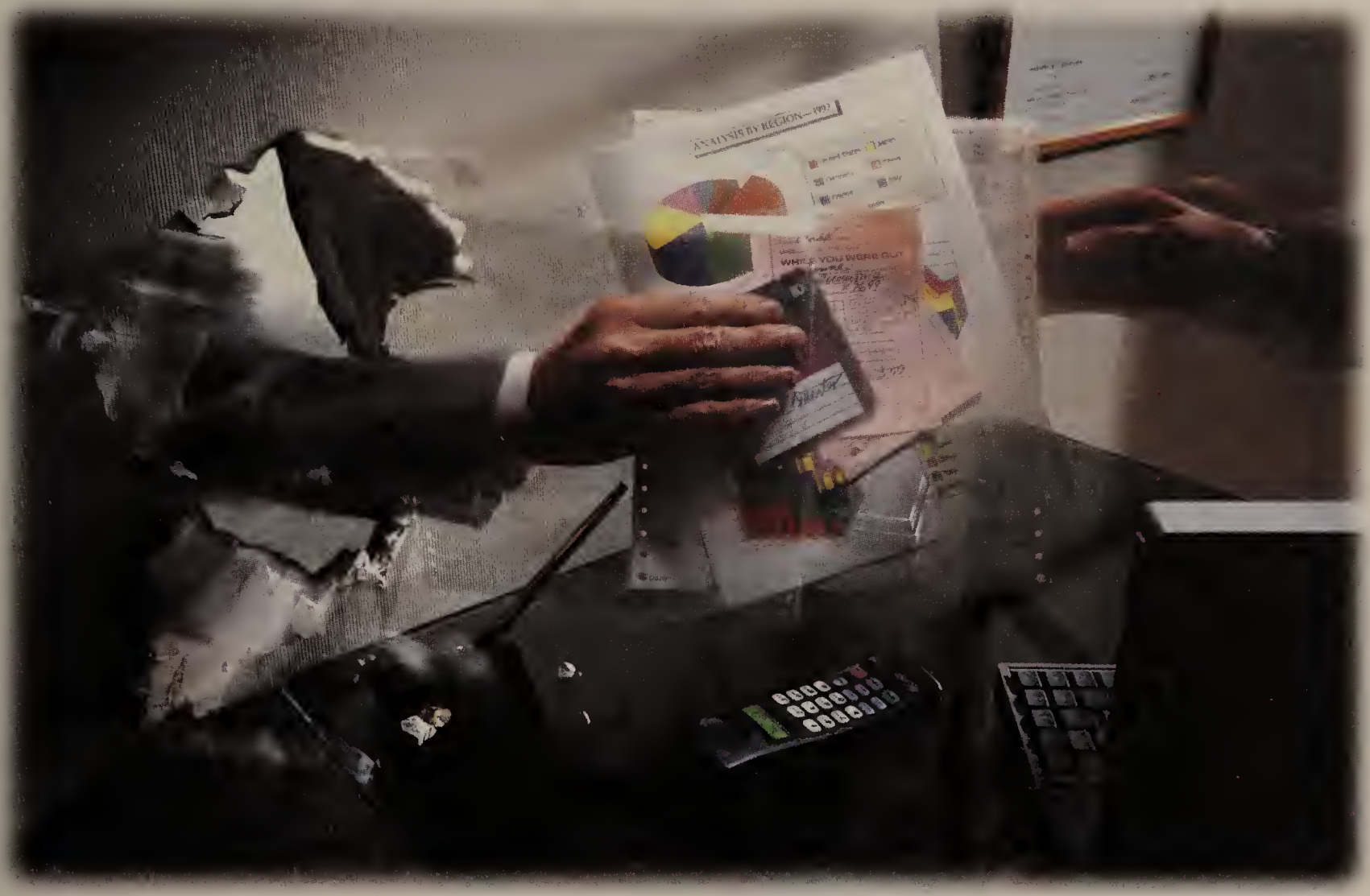

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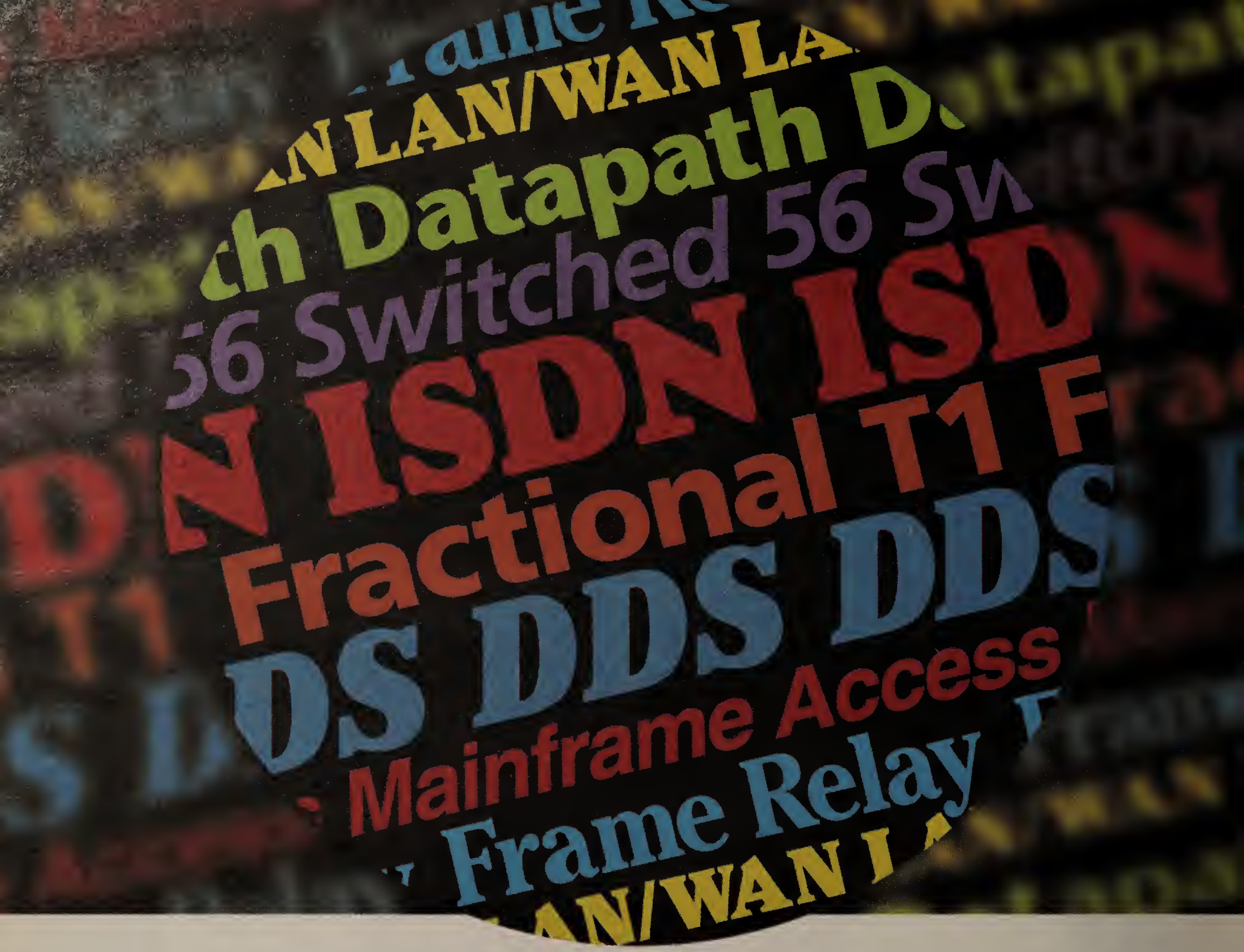

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BRIEFS

IBM and **Hewlett-Packard Co.** have announced an agreement to make IBM's DB2 database technology available on the HP 9000 platform. HP customers using HP 9000 workstations and servers will be able to participate in DB2 environments and will be the first non-IBM product family to support the DB2 relational database management system. The ability for the HP UX-based 9000 products to support DB2 will be a significant step for customers looking to move to an open systems environment.

IBM has announced a new version of its IBM Mail LAN Gateway/2 featuring support for IBM's OfficeVision VM and Professional Office System (PROFS) electronic mail systems. Version 2 of IBM Mail LAN Gateway/2 also adds support for Worldtalk Corp.'s Worldtalk 400 X.400 gateways.

The IBM gateway already supports a number of IBM and non-IBM E-mail systems, including Lotus Development Corp.'s Notes and cc:Mail, and IBM's OfficeVision/400. The local-area network-based gateway software is available now and costs between $2,000 and $10,000, depending on the number of users authorized to access it.

BLOC Development Corp. and **Action Technologies, Inc.** last week announced that BLOC will begin selling a work flow-enabled forms routing application software package based partly on the Action Workflow System. BLOC's F3 Workflow System will run in conjunction with Microsoft Corp. SQL Server and Lotus Development Corp. Notes. It will also run across various client computer platforms, including Windows and Apple Computer, Inc. Macintosh computers. F3 Workflow System will be available this fall on SQL Server and Notes. Basic configurations for the SQL Server and Notes versions will start at about $10,000 and $6,500, respectively.

BLOC: (305) 567-9931.

IBM, based in Armonk, N.Y., and **Open Environment Corp. (OEC),** based in Cambridge, Mass., have signed an agreement under which they will jointly market the OEC Toolkit, a set of client/server application development software.

Separately, OEC announced Version 1.1 of OEC Toolkit, which will be available Oct. 25. New features include support for Easel Corp.'s Enfin application development tool and OS/2 clients. The software costs $8,000 for two to six developers, plus $2,000 for a run-time license.

OEC: (617) 499-1613.

Digital Communications Associates Inc. (DCA) has announced QuickApp for Windows 1.1, a new version of its middleware software designed to let developers build client/server applications with access to host data. The new

See **Briefs,** *page 40*

HP unleashes objects for distributed computing

New tools simplify building of network apps.

BY WAYNE ECKERSON

Palo Alto, Calif.

Hewlett-Packard Co. last week extended its reach into the world of distributed object computing by announcing an object model that works with the Open Software Foundation, Inc.'s (OSF) Distributed Computing Environment (DCE).

Object Request Broker (ORB) Plus provides an object-oriented interface to DCE, simplifying the process of building distributed applications. DCE provides an integrated set of services for connecting applications in a heterogeneous, distributed computing environment.

HP also announced a second beta version of its Distributed SmallTalk object development environment that incorporates enhancements suggested by beta customers, including a run-time version and remote object browsing capabilities.

ORB Plus and Distributed SmallTalk are key elements of HP's strategy to provide a comprehensive set of tools for building distributed applications, said Mike Matthews, HP's distributed computing product manager.

Distributed SmallTalk, which uses Sockets as an underlying transport, is geared toward building applications for work group environments. ORB Plus, with DCE as its plumbing, is geared toward building enterprisewide applications.

HP plans to integrate the products so objects created with either tool can interoperate and work across heterogeneous application platforms. Currently, ORB Plus is based on C++, and Distributed SmallTalk is based on SmallTalk.

"We've defined how SmallTalk objects can communicate with C++ objects. That will be in the next release of ORB Plus," Matthews said.

According to Matthews, HP is the first vendor to offer DCE support within an object-oriented development environment. That's an edge for HP because many customers are eager to deploy DCE but want to make it easier for programmers to use, he said.

"ORB Plus abstracts all of DCE's services up to an object [application program interface] so developers don't have to learn DCE to build distributed applications," Matthews said.

ORB Plus is being beta-tested by

See **HP,** *page 40*

Users contend with the challenge of multimedia

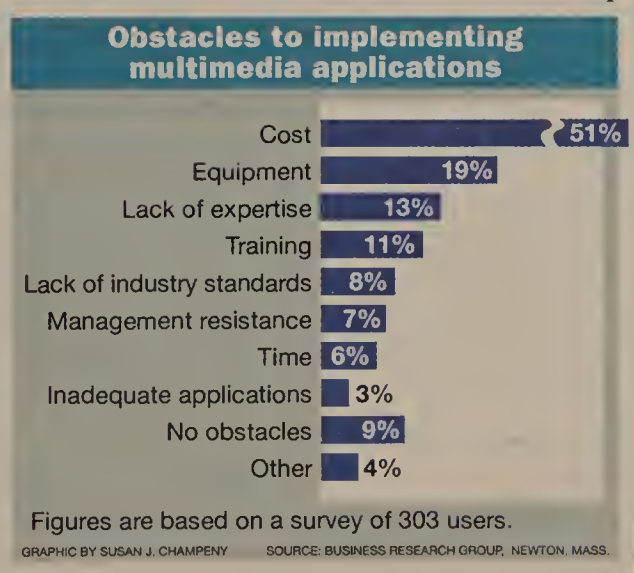
BY PETER LISKER

Newton, Mass.

Multimedia applications are making their mark on corporate nets, but users are wrestling with some fundamental questions about deploying these new systems in a networked environment, according to a new study from Business Research Group (BRG), based here.

The BRG study shows that slightly more than half (54%) of users with multimedia applications had deployed them on local-area networks, while only about one-quarter (26%) run them over wide-area networks. That number is significant because the respondents were currently multimedia users, essentially the bleeding edge of the multimedia technology curve. Another 5% said they would deploy wide-area multimedia applications over the next two years.

While traditional thinking has been that technical constraints are the key factor in acceptance of multimedia applications, the study showed that the



See **Multimedia,** *page 39*

ELECTRONIC MAIL

by David Ferris

And the wall fell down

Most users of IBM's mainframe electronic mail systems — PROFS and OfficeVision — are migrating to PC-based E-mail. While the shift is difficult for people making heavy use of the products' shared calendars, there are some solutions available.

IBM's products combine mail, calendaring, scheduling and document libraries. Although they're quickly being replaced by personal computer systems, they're still the most common mail environments.

Professional Office System (PROFS) runs on VM hosts and has been available since 1982. OfficeVision (OV) was launched in 1989, and there are versions for VM, MVS and the Application System/400. I use "PROFS/OV" to collectively refer to PROFS, OfficeVision/VM and OfficeVision/MVS.

MAKING THE MOVE

It's usually not practical for PROFS/OV users to migrate to PC E-mail in one swoop. It's best to move gradually and connect users of the new and old systems via a gateway during the transition.

There will likely be two or three gateways you can use, depending on the PC mail system you've selected. These convert messages between PC and PROFS/OV formats, and many also provide for directory propagation and basic file transfer.

For information on some of the best gateways, call Microsoft Corp. at (206) 882-8080; Soft•Switch, Inc. at (215) 640-9600; and LinkAge at (416) 862-7148.

But there's a fly in the ointment. Roughly one-third of PROFS/OV sites make heavy use of calendaring, and most gateways can't handle calendar interaction. Users on one system can't arrange group meetings involving users on the other. That's a major stumbling block. Because of the importance of shared scheduling, many companies have been forced to keep everyone on PROFS/OV, whether they like it or not.

THE WALLS COME DOWN

Recently, however, PROFS/OV gateways have improved. Microsoft was the first major vendor to grapple with the problem, and its MS Mail gateway to PROFS/OV provides good, basic integration with Microsoft's Schedule+ scheduler. The latest version lets both sides browse through workers' "free" and "busy" times. Users can request and accept meetings with people on the other system, and everyone uses the procedures typical to their environment.

But neither side has access to calendar detail. For example, Schedule+ users can't tell what a PROFS/OV user is doing during a busy time, and they can't book resources such as a meeting room sched-

See **Wall,** *page 39*

COMPUTERIZED CATALOGING

French library to check out multimedia programs

BY MARTIN LAMONICA

Paris

France's new national library plans to implement a computerized cataloging system that promises to let visitors effectively consult images, video and audio archives through a single PC-based point of access.

By the autumn of 1996, the technical design staff at the Bibliotheque de France plans to install a network that lets several hundred researchers access terabytes of information stored in databases and optical disks. The system will let researchers manipulate different media types on a single document locally — a capability previously unheard of in France's public libraries.

The network's front-end applications will also provide visitors with features such as hypertext searching across multiple documents — instead of poring over microfiche — or letting users download a recorded speech or film and play it back. This system aims to "go beyond simple consultation and let full-time researchers collate images as well as text and create montages when creating a corpus," said project director Dominique Maillet.

The initial avalanche of digitized information will include 100 million scanned books, 600 million still images and 20,000 hours of recorded sound. Maillet's staff of 30 information systems (IS) people is subcontracting much of the digitizing work to companies such as Eastman Kodak Co., which is in charge of photos, and even to prisoners outside of Paris who have been trained with high-speed scanners to transfer books to CDROM. Video that the library manages to attain will be retained in analog form and downloaded directly to client posts.

This system will let researchers manipulate different media types on a single document locally.

Full-time researchers will be able to use between 200 and 300 "audiovisual" PCs, running Unix and equipped with CDROM drives. Several hundred Windows PCs with high-resolution screens will be available to the public for downloading only digitized texts and images. Users will also be able to refer to the library's catalog via 1,000 computer terminals, such as those found in most computerized libraries.

The library is developing the software on NeXT Computer, Inc. and Sun Microsystems, Inc. workstations with a model program supplied by Cap Sesa Logiciel and publisher Berger Levrault. Maillet said she plans to buy specialized multimedia programs off the market as much as possible and add features to fit researchers' needs. The IS staff will also integrate security functions, strictly limiting what information and how much of it users can legally copy.

In the first phase, the library's audiovisual posts will not be able to mix video and text in the same document because it would overload the software and would require different types of screens, Maillet said. The staff is also experimenting with configurations capable of treating text, sound, images and photos simultaneously, she added.

The computer consultation system will also include between five and 10 Unix servers to manage simultaneous access to a jukebox of optical disk drives. To aid in this management, the library will magnetically stock a part of its archives on relational databases. Maillet will postpone the choice of a Unix server vendor as long as possible because "hardware price/performance ratios in 1996 will have nothing to do with those of 1993," she said.

Although she has not yet decided on the exact network architecture, Maillet said she plans to employ a fiber-optic backbone, possibly directly to the Unix clients, and is considering high-speed Ethernet local-area loops. Maillet claimed the system will eventually be able to support up to 12 terabytes of data as the library's digitization project evolves.

"The idea to create an electronic 'bank' [of the library's possessions] was the starting point of our work," Maillet said. "There won't be another library in the world that does what we are doing so exhaustively, with the same volume and the capabilities of different media."

Once completed, the Bibliotheque de France plans to go on-line with other computerized libraries abroad.

LaMonica is a correspondent for IDG News Service.

Multimedia

Continued from page 38

cost of reworking networks to support bandwidth demands is a bigger impediment. Respondents also cited a dearth of network-capable multimedia applications as an obstacle to success.

"Our study found that the cost, including increasing network bandwidth to support multimedia applications, is definitely a limiting factor in corporations offering multimedia application services in a networked environment," said Cheryl Ball, a senior industry analyst with BRG.

"Stand-alone multimedia users who champion the technology are usually unaware of the network implications of running multimedia and often don't understand that there is a significant difference in the two environments," she said.

Nearly 80% of survey respondents said the client/server applications they are building now will incorporate text, graphics and images. Other multimedia elements, including voice, video and music, will put heavier demands on the network and, for the majority of users, applications supporting them are farther off in the future.

Respondents said the most popular area of multimedia use was in applications for information delivery and management. The more pie-in-the-sky applications, such as multimedia databases, design visualization and virtual reality systems, are of intense interest to users, though few are actually deployed at present.

For net managers being harangued by enthusiastic users who want to immediately implement networked multimedia applications, Ball said, "Network personnel have to remember that the majority of multimedia users are very naive from a network standpoint and need to be educated about the realities of networking. We had an amazing 22% of our survey participants say they expect to run multimedia over wireless networks, which obviously shows a distinct lack of knowledge."

©BRG: (617) 630-3900.

Wall

Continued from page 38

uled through PROFS/OV.

Users need seamless access to the calendar database of the other side. To do this, the PC system has to fool PROFS/OV into thinking it's another PROFS/OV system. This isn't simple because IBM has been secretive about how PROFS/OV scheduling works.

Nevertheless, gateways of this type have started to appear. In January, Seattle-based Attachmate Corp. announced ZIP!Office. This excellent PC E-mail and scheduling product was the first to give a real migration path for PROFS/OV scheduling users.

The second gateway to provide full PROFS/OV emulation is being released at the time of this writing. It's designed for WordPerfect Office, an integrated office suite from Orem, Utah-based WordPerfect Corp. The scheduling integration will be seen as a major competitive strength of WordPerfect Office.

The industry is also taking steps to define calendaring application program interfaces. Pioneering work is being done by a group of vendors involved with Novell, Inc.'s NetWare Global MHS. Known as the MHS Alliance, the consortium is headed by ON Technology, Inc.'s John Rizzi, who can be contacted at (617) 734-4317. Attachmate is participating and will provide a tightly integrated PROFS/OV gateway.

While the main barrier to smooth migration from PROFS/OV is being dismantled, a few lower hurdles remain. In particular, it's not easy to move PROFS/OV bulletin boards or rewrite mail-enabled applications. But the writing's on the wall, and liberation for users locked into PROFS/OV calendars is at hand.

Ferris is president of Ferris Networks, a San Francisco-based E-mail research firm. He writes a monthly newsletter, "The Ferris E-Mail Analyzer."

DATA NETWORKING LEADERSHIP

HOW DOES AMERICAN AIRLINES MANAGE A NETWORK THAT HANDLES 500,000 RESERVATIONS EVERY DAY?

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HP

Continued from page 38

several telecommunications and financial services firms. A developers' kit will be made available in the first part of 1994, with general availability scheduled for some time next summer.

ORB Plus will initially run on HP Apollo 9000 Series Model 700 and Model 800 Unix processors running HP-UX. The software will eventually be deployed across most platforms supported by DCE, Matthews said.

ORB Plus consists of a standards-based object request broker, object services such as naming and location, developers' and administrative tools, and sample applications.

The new Distributed SmallTalk version supports an object browser and run-time version, and lets users run multiple Distributed SmallTalk-based applications on one system. It also offers a 400% performance boost over the previous version via quicker exchange of remote messages and reusable object libraries.

Hewlett-Packard Co.'s Object Request Broker (ORB), called the Distributed Object Management Facility, is based on Version 1.1 of the Object Management Group's Common ORB Architecture, which specifies how objects request and receive services across a network.

Distributed SmallTalk applications currently run on HP, Sun Microsystems, Inc. and IBM Unix workstations, and will eventually run on Macintosh and Windows personal computers.

✆HP: (408) 447-1415.

Aurem releases new sales force automation software

BY BOB BROWN

Santa Clara, Calif.

Aurem Software, Inc. has released a new client/server application for automating field sales operations and a new complementary version of its telemarketing software.

SalesTrak for Windows is designed to give field sales personnel using laptop or notebook computers access to current, centrally located corporate and customer data. The software enables them to access to-do lists, information on sales leads, competitive data and price quotes, among other things.

TeleTrak 4.0 is a new release of the company's software for automating telesales and telemarketing operations. This software helps telesales and telemarketing representatives qualify sales prospects, update contact information and distribute product literature in a coordinated manner.

BUCHANAN

All of Aurem's applications, which also include customer support, field service and quality management offerings, store information in a central Oracle Corp. or Sybase, Inc. database, which is accessible via any of the applications. This architecture is especially useful for organizations with SalesTrak and TeleTrak, which can be used together to allow for team selling, said Dave Buchanan, executive vice president of Aurem.

SalesTrak consists of client and server software, said Tom Gregory, director of engineering for portable computing products at Aurem. The client piece, which mainly handles data presentation, is based on Gupta Corp.'s SQLBase database engine and has been written using Gupta's SQLWindows application development tool, he said. The client software provides end users with various views of the data in its database.

The server software includes the database as well as security and systems administration components.

Field sales employees access the server database via a dial-up, direct or wireless connection to get updates on new leads, which are forwarded to the database via the TeleTrak application users and other SalesTrak users. The product synchronizes data on the server and individual laptops.

The employee can access information, such as competitive data, from the laptop PC database right at the customer prospect site.

The field sales employee can then call new leads, schedule appointments and create price quotes for new prospects.

The employee can also access information, such as competitive data, from the laptop PC database right at the customer prospect site. Because the application supports Microsoft Corp.'s Object Linking and Embedding and Dynamic Data Link technologies, Windows-based documents can be attached to customer files on the laptop PC.

Aurem has been marketing a Unix version of SalesTrak, but that product has not sold well, largely because field sales personnel are more likely to have Windows rather than Unix-based portables, according to Buchanan.

SalesTrak for Windows is priced at $1,595 for a single-user license, while TeleTrak 4.0 is priced at $27,500 for a 10-user license. Both applications will be available by October.

✆Aurem: (408) 562-6370.

Comments

If you have a comment on this or any other article, drop us a fax at (508) 820-3467 or call (800) 622-1108, Ext. 487.

BRIEFS

Continued from page 38

version of the software adds support for Microsoft Corp.'s Visual C++ development software and Powersoft Corp.'s PowerBuilder software. Support for KnowledgeWare, Inc.'s ObjectView will be included in a future edition. DCA also announced access to data on multiple hosts. QuickApp for Windows 1.1 will be available in October for $995, with an upgrade from Version 1.0 for $195.

DCA: (404) 442-4364.

Blyth Software, Inc. recently announced OMNIS7 for the Application System/400, a client/server development environment that allows Microsoft Corp. Windows and Apple Computer, Inc. Macintosh clients to access data on AS/400 computers. OMNIS7 provides connectivity to the AS/400 via Microsoft's Open Database Connectivity interface, Apple's Data Access Language, Information Builders, Inc.'s Enterprise Data Access/SQL and TechGnosis, Inc.'s SequeLink. The product will ship this fall.

Blyth: (415) 571-0222.

Digital Equipment Corp. and **Russell Information Sciences, Inc.** have signed an agreement under which DEC will market, distribute and support Russell's Calendar Manager group scheduling product worldwide. The product runs on a variety of DEC hardware and software server platforms and an assortment of clients.

NCR Corp. and **Oracle Corp.** today are expected to announce NCR's LifeKeeper Fault Resilient System (FRS) Clusters, which brings parallel processing capabilities to users of NCR hardware and the Parallel Server feature of the Oracle 7 database.

LifeKeeper FRS Clusters consists of two major software components. It is the core software responsible for synchronization between database systems, while LifeKeeper Distributed Lock Manager (DLM) maintains the configuration of the clustered systems and controls the data locks needed for data integrity and consistency.

LifeKeeper FRS Clusters can run on two to four NCR 3400 and 3500 systems and includes support for Intel Corp. Pentium processor-based systems.

Pricing of LifeKeeper FRS Clusters ranges from $9,000 to $40,000 per system. A stand-alone version of LifeKeeper DLM for users that do not require the switchover capabilities of LifeKeeper FRS is available for $4,000 to $20,000 per system.

NCR: (800) 225-5627; Oracle: (415) 506-7000.

Editorial

Nothing in our pages this year has drawn a stronger reaction than our Opinions pieces on Novell's Certified NetWare Engineer (CNE) program.

Last month, user columnist Douglas Welch complained that obtaining certification costs too much — a problem Welch claimed is keeping some qualified candidates from achieving CNE status and, as a result, jobs. (Aug. 2, page 33). Readers weighed in on both sides of the issue, with one even claiming *Network World* has an ax to grind about CNEs.

Welch was fanning the flames of a fire started in March, when consultant James Carlini wrote that CNE status is overrated and its Novell-centric approach too narrow for the mixed technology world of today (March 8, page 46). That drew howls of protest from readers who lambasted us for misrepresenting the process of obtaining a CNE. Readers were right; we dropped the ball, plain and simple, on what it takes to become a CNE.

But few commented on the core of Carlini's piece questioning the CNE's value. Those that did tended to agree that the CNE is useful for employers who want some proof of a prospective employee's skills but is of limited value in indicating "real world" experience in diverse net environments.

While I wish we hadn't shot ourselves in the foot with the requirements gaffe because it obscured the point of the column, I agree with Carlini. If you're hiring for a job that revolves around NetWare, a CNE is valuable — provided the candidate has real experience. But executives shouldn't assign too much weight to a certification focused on one proprietary product. That some hiring managers may rely overmuch on the CNE is understandable; however, given Novell's dominance and the paucity of rigorous certification programs in the network industry.

In that vein, I was intrigued by news last week of the formation of the National Association of Communication Systems Engineers (NACSE). NACSE, which can be reached at (303) 689-0825, has proposed an ambitious four-level certification process for network professionals, and it's worth your while to check out their plans (Sept. 20, page 1.)

But the NACSE effort raises big questions. First, can anyone really design a testing process that accurately evaluates an employee's knowledge and skills across a broad range of technologies? More important, will employers find such a certification system valuable? Will it make it easier to hire?

You do the hiring around here. Let me know what you think.

JOHN GALLANT

Teletoons

FRANK AND TROISE

REALITY CHECK

by Thomas Nolle

Bellcore proposal may give SMDS needed push

Bell Communications Research's proposal to make Switched Multimegabit Data Service (SMDS) available at 56K bit/sec speeds (*NW*, June 21, page 4) may be just the push SMDS needs to finally take off. The proposal might wake up the market for a service that seems to be slipping into the same limbo that has already claimed Integrated Services Digital Network.

SMDS, as originally proposed, was a kind of metropolitan-area Fiber Distributed Data Interface net designed to be either a backbone local-area network or a fast way to link client and server systems directly over citywide distances. Because SMDS was, in effect, a LAN, there was a tendency to compare it with evolving premises LANs and thus to promote higher speeds.

But unlike LANs, SMDS is a service with a monthly recurring cost. While that cost varies from region to region because of individual local exchange carrier pricing policies, T-3 SMDS costs about $2,000 per month, and T-1 SMDS about $800 a month. You wouldn't have many backbone LANs if those kind of recurring charges were assessed on the premises.

Bellcore hasn't entirely given up on making SMDS faster though. It is working to make SMDS run over 155M bit/sec Synchronous Optical Network links. But Bellcore recently introduced two Technical Advisories aimed at making SMDS cheaper first.

The first, called the SMDS Data Exchange Interface (DXI), describes how SMDS services would be offered at 56K or 64K bit/sec, using the same information formats now employed for on-premises connection of SMDS routers to SMDS data service unit/channel service units (DSU/CSU). Because 56K and 64K bit/sec lines are a lot cheaper than T-1 lines, this would allow SMDS to be offered for as little as $150 per month. In addition, because the carrier accepts the data format already produced by the router, a standard DSU/CSU can be used.

If bargain basement SMDS isn't enough, in its second Technical Advisory, Bellcore proposes a hybrid of SMDS with the more popular frame relay technology. Called SMDS Interface Protocol Relay Service (SIP Relay), the proposed standard calls for transporting SMDS data on one of the reserved frame relay Data Link Connection Identifiers — the frame relay equivalent of a virtual circuit number, which separates conversions from one another — thus keeping it separate from user frame relay traffic. SIP Relay could be used to offer a frame relay subscriber SMDS services at a modest incremental cost.

DXI and SIP Relay would, in combination, add more than 40,000 SMDS prospects, based on our studies on willingness to pay for LAN internetworking applications. Lowering the threshold cost for SMDS service makes it more likely that users will be able to justify SMDS for all their locations within a given service area, and that increases the value of SMDS.

There's also a "socialization benefit." Because SMDS is connectionless, it doesn't limit users to fixed partner relationships. Any pair of SMDS users who agrees to interchange data can do so. The greater the number of SMDS users, the more likely other users will find it valuable to communicate with these preexisting users and therefore subscribe to the service. It's like the Internet; do you get on it to transmit traffic or to interact with other users already on it?

So should you run out to your local Bell salesperson and demand SIP Relay or DXI? If you do, don't hold your breath. None of the SMDS carriers offer either one, and when — or if — the carriers offer it will depend on two factors: customer premises equipment support and SMDS switch support.

For router vendors who support SMDS today, DXI will mean little or no change in software. However, many router vendors still don't support SMDS. For example, IBM's 6611 doesn't have SMDS support yet. Even the router vendors who support both SMDS and frame relay will have to make some software changes to support SIP Relay, which requires that SMDS and frame relay features be intermingled on the same wide-area port. So far, none of the router vendors have jumped on the SIP Relay or DXI bandwagons, and without CPE support, neither service will get anywhere.

The situation is similar on the SMDS switch side. Companies that are more or less committed to SMDS, such as Siemens AG and its U.S. subsidiary, Siemens Communications Systems, Inc., AT&T Network Systems, Inc. and Fujitsu America, Inc., are interested in anything that popularizes it. However, until there is an indication that CPE will be available, each is reluctant to give SIP Relay or DXI much priority. These firms must juggle resources between SMDS, frame relay and Asynchronous Transfer Mode (ATM), and right now, SMDS isn't the most promising of the three.

Let's watch the market a while, the switch vendors say. The carriers then cite lack of switching as their reason for not offering SIP Relay or DXI services. Then the router vendors say that without services, they can't justify CPE. Everybody is getting dizzy watching everybody else, and nothing is moving.

This, unfortunately, is the life story of SMDS. The only way to break this logjam would be to have some effective national promotion of SMDS concepts, emphasizing low-threshold forms of SMDS like SIP Relay and DXI to encourage user experimentation. But such a campaign, launched by the regional Bell holding companies, would constitute illegal collusion, and there is no incentive for other market players to launch it. In fact, some SIP Relay advocates are hoping that by linking SMDS and frame relay, SIP Relay will draw on some of the aggressive frame relay marketing and succeed in spite of itself.

SMDS, even at T-1 rates, is an economic breakeven for LAN internetworking at the level of three or four sites in a metropolitan area. With SIP Relay and DXI, it could be even better. But nobody wants low-speed SMDS unless they want SMDS in the first place.

Pacific Bell and Bell Atlantic Corp. have proved that SMDS can be sold. Unless these two RBHCs champion SIP Relay and DXI, neither will achieve a fraction of their potential. If that happens, SMDS won't achieve much either.

Nolle is president of CIMI Corp., a technology assessment firm in Voorhees, N.J. He can be reached at (609) 753-0004 or via MCI Mail at 349-5845.

CLIENT/SERVER

by Thomas Henderson

Client platform should fit environment

Contrary to some opinions, the only right choice for a client/server development platform is the environment in which the developed code will eventually have to operate.

In a previous column about Microsoft Windows as a development platform for client/server (*NW*, July 5, page 32), Richard Finkelstein made some strong statements about Windows' deficiencies. But neither of the alternative platforms to Windows he suggests — namely IBM's OS/2 and Novell, Inc.'s UnixWare — offers any inherent benefits for both in-house and product development efforts. Further, the arguments he raises are largely rehashed vendor propaganda.

This much about Windows is true: Windows 3.0 was let out of the oven before it was baked. It wasn't and isn't stable for client/server or any other applications. But Windows 3.1 is for, the most, part stable and has become the desktop work environment and platform of choice for hundreds of thousands of commercial installations. Our patrons that use Windows as the client in the client/server relationship don't have the instability that Mr. Finkelstein discusses.

IBM's OS/2 has become popular as a client/server development platform, as well, but it offers little inherent improvements in platform stability. In fact, I succeeded in crashing every OS/2 2.0 machine in the Comdex/Fall '92 Press Room in 20 seconds. I simply changed the port address inside of Procomm Plus, then exited Procomm. I was motivated: IBM's crash helmet ad, and a nearby platform bigot in the room, got the best of me. It was a skeptic's reaction to those that purport a quality of their product that simply isn't true. I'll find a way to crash OS/2 2.1 too if you'll just give me a couple of minutes.

The client/server architecture implies an inherent distributed computing model. A workstation of some kind propagates a query to a server, which in turn thinks about the query, then delivers an answer.

A mainframe, minicomputer or hefty microcomputer can be the server; the client hardware should be anything a user wants, right down to a Nintendo Game Boy, if that's the eventual target of the application development. Of course, it's mandatory that any member of the client/server data delivery chain be stable.

Unless the application development is performed on the targeted environment, an expensive debugging step becomes interjected into the life cycle of the code for the client/server application developed — a test of quality assurance in a nonproduction environment. But nothing prevents any coder from making the wrong move — writing code that either doesn't work or destablizes an installation.

A feature that helps an operating system stabilize its memory model is a plus. But whatever inherent stability is purchased with memory model control is just a singular element of an operating environment. And that's what Windows is: a graphical platform with a legacy, character-based (and occasionally stunting) environment. The tired argument that an operating system has no "protection" as a function of its memory model can be weighted against the sales of Windows (pick a number over 20 million) and Novell's NetWare 3.X (pick a market share percentage above 40%). Neither Windows nor NetWare has inherent memory protection.

In commercial environments, Windows and NetWare 3.X aren't dropping like flies. Instead, they're outselling and outdeveloping OS/2 and Unix because they run on cheaper hardware, have outstanding third-party product support, have a staggering variety of development tools and have tremendous intellectual capital associated with them. And the variety of combinations of hardware, software and programming tools can admittedly make software development a little wiggy. Multivendor application solutions are inherently more complex.

Client/server environments are no different from any other production function: Data has to be processed.

There's a ghastly silliness in purchasing OS/2 or any other development environment for its memory model, which provides, at best, a slight immunity from sloppy programming. And watch the face of computer novices when you sit them down in front of Unix for the first time.

My point is to code on the platform that your installed base has to use. Like it or not, it's what users and adminstrators must face. Ignore manufacturers' competitive propaganda; choose a development platform based on the environment the code has to work on. Anything else becomes more expensive than it needs to be. Why make client/server tougher than it already is?

Henderson is the chief technical officer at Unitel Corp. in Indianapolis, a communications and database integrator. He can be reached via MCI Mail at 457-9580.

Letters

Monitoring our progress

Thank you for the "Internetworking Monitor" column about network system technical standards (Aug. 30, page 14). Again, a subject that is very vital in understanding our emerging "information society" was dealt with in a way that gives even us nontechnical people some very helpful perspective.

John Siewert
Project manager
World Vision International
Monrovia, Calif.

A question of ethics

Regarding your editorial on electronic mail privacy issues (Aug. 30, page 50):

I am an employee of the state of Wisconsin as a network administrator of two networks for a residential institution, the Central Wisconsin Center. Our general policies were in place when I started here in 1992, but I have helped revise them to prepare ourselves for the arrival of E-mail. We have had E-mail for about seven months and will soon be connected to a statewide wide-area network. Our policies are being used by other state facilities to help formulate their own privacy policies.

Our privacy policies read in part:

"Although the state can retain legal ownership (copyright) of information created by employees during employment, employees who create or manage information at Central Center control access to that information on computer systems. Generally the principle is: the person who creates information controls access to it.

"Data Center staff have the authority, responsibility and need to intercept, retransmit and scan any or all information stored or processed on all computer systems at the Center from time to time. As a matter of policy, Data Center staff do not release information or give access to any information without permission of the person or department that has ownership of the information. The Data Center refrains from taking ownership (control) of information created by other departments and users.

"Issues of privacy and unauthorized use always accompany electronic data transmissions sent between users of computer systems. For example, there is no guarantee that a sensitive electronic mail message sent to an employee actually arrives at the proper destination without an intercept. Highly confidential and private messages or reports should be delivered by other communication channels, if privacy is a major concern."

I have not personally scanned any other employee's E-mail, and I believe that is true of our entire Data Center staff.

In addition to the above policy excerpts, I am certified as an Associate Computer Professional by the Institute for the Certification of Computer Professionals and am bound by their policies concerning ethics. If a conflict should arise, I will comply with my certification ethics before those of my workplace. However, we have not had any problems with our policies and do not anticipate having any in the future.

For copies of our policy, interested parties can contact me via CompuServe at 72234,666.

Alan Downs
Management information specialist
Central Wisconsin Center for the Developmentally Disabled
Madison, Wis.

Schmall wonder

I found Eric Schmall's article about the passive-aggressive manager (Aug. 30, page 43) quite interesting because it describes much of the work environment a friend at another company is unfortunately experiencing. However, the article did not state who Eric

See **Letters**, *page 58*

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Our Networks Mean Business

Buyer's guide

Menu madness

BY MARK A. MILLER

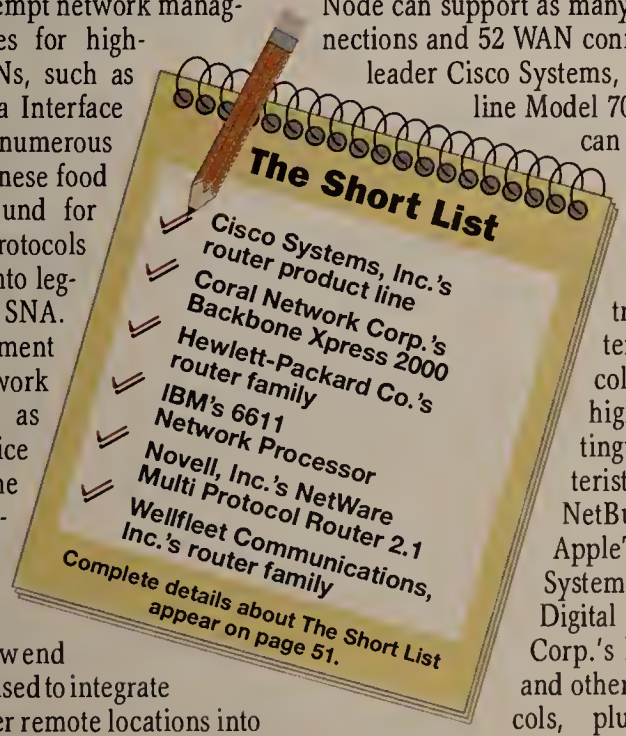
Vendors cook up a variety of new router entrees and side dishes that make it difficult to select the router best suited to users' tastes.

Just when users thought they had a firm grasp on their internetworking strategies, with all the hardware selected and the protocols in place, along come the router vendors with a smorgasbord of new options and features.

Selecting a router in today's market involves much more than just picking one vendor's entree over another. The entire internetwork architecture must be considered, for present — and future — conditions. On the hardware side of the router equation are the type, number and speed of the local- and wide-area network interfaces. It is, however, router software that is the deciding factor in any router purchase. Network designers must look at the predominate protocols on the backbone, including Transmission Control Protocol/Internet Protocol, Internetwork Packet Exchange (IPX), DECnet and Systems Network Architecture, and then weave these into a cohesive — and technically compatible — tapestry.

Users are demanding more from their routers, including a price/performance ratio suited to their application; modularity; scalability; multiprotocol and bridging support; not to mention verified benchmark results on throughput, high reliability and extensive vendor support.

And the router chefs have been busy cooking up new cuisine to tempt network managers' palates. Interfaces for high-speed LANs and WANs, such as Fiber Distributed Data Interface and frame relay, are as numerous as the choices at a Chinese food buffet. Strategies abound for integrating LAN protocols such as Novell's IPX into legacy networks such as SNA. Network management using Simple Network Management Protocol as well as extended service agreements to keep the network up and running are also quite prevalent. Most importantly, a new breed of router, focused at the low end of the market, is being used to integrate branch offices and other remote locations into the enterprise internetwork.



THE HIGH GROUND

Regardless if users are looking for a unit with all the trimmings, or a bare bones model, router choices abound at both the high and low ends of the spectrum. In the typical star topology — and to some extent in mesh networks — high-end routers are found at the core; low-end devices are located around the periphery. Pricing stratifies into two segments as well, with model costs in excess of $10,000 — indicating a high-end router — while low-end units sell for around $5,000.

The high end of the router market is distinguished by the wide range of LAN and WAN interfaces available on a unit. Wellfleet Communications, Inc.'s Backbone Concentrator Node can support as many as 52 LAN connections and 52 WAN connections. Market leader Cisco Systems, Inc.'s top-of-the-line Model 7000, for instance, can support 30 LAN connections and 40 WAN connections.

The menu of transport and inter-router protocols available at the high end is also a distinguishing characteristic. 3Com Corp.'s NetBuilder II handles AppleTalk, Banyan Systems, Inc.'s VINES, Digital Equipment Corp.'s DECnet, TCP/IP and other transport protocols, plus Intermediate System to Intermediate System (IS-IS), Open Shortest Path First (OSPF) and the Routing Information Protocol (RIP) interrouter protocols. Widespread support in this area is beneficial to managers of multiprotocol, multivendor distributed internetworks.

A third characteristic is in the performance area, benchmarked by the router's throughput and measured in packets per second. High-end devices are more likely to hit the theoretical upper limits of performance, although some lower cost products can boast favorable results, as well.

Specific design requirements may also play an important role in product selection at the high end. Look for SNA support, bridging capabilities, data compression, comprehensive redundancy and remote configuration/management as other features that separate high-end and low-end offerings. Products from Ascom Timeplex, Inc., Cisco, Coral Network Corp., Cray Communications, CrossComm Corp., Proteon, Inc., Retix and Wellfleet exhibit strengths in these areas of the high-end marketplace.

While high-end routers are used to build internetwork backbones, mid-range to low-end devices provide cost-effective connectivity for branch offices and various departmental LANs. At INTEROP 93 in San Francisco this past August, Tom Steding, vice president of strategic marketing at 3Com, discussed a spate of recent activity in the low-end of the router market.

Steding's findings revealed that general-purpose low-end routers typically support either IP or Novell's IPX, or both. They likely will come with just one LAN and one WAN port — generally the Ethernet and serial variety, respectively. The operating system is stored in flash erasable programmable read-only memory, and may have few complex features, such as address filtering and data compression. For basic LAN interconnection, however, these devices fill a definite market need. And there's been quite a bit of product activity at this end of the market; almost all of the vendors surveyed offer at least one router in the mid-range to low-end market (see related story, page 50).

Sidney Kriger, product manager of Access Products at Wellfleet Communications, in Billerica, Mass., says the high-end and low-end of the router market are two components in an enterprise-wide internetworking solution. The high end requires high performance, high availability and high reliability. The low end needs to be a cost effective platform providing LAN-to-WAN connectivity from remote branch sites to a central site. Both the high and low end need to support a variety of WAN services and features to give the customer flexibility in network design."

DESIGN, PERFORMANCE ISSUES

Whether an internetwork is designed from a LAN-centric or WAN-centric view depends on the specific goals of the enterprise. The place of the router within that internetwork — whether at the core with a high-end device or

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Router selection criteria

■ Modularity — The ability to include additional local- or wide-area network interfaces as net requirements or new technologies emerge.

■ Scalability — The degree to which the system can meet the requirements of both low-end and high-end systems.

■ Multiprotocol support — The ability to route all of the protocols present in the internetwork, including LAN and legacy data streams.

■ Bridging — Not all protocols are technically routable, so routers should possess the ability to bridge protocols.

■ Optimum price/performance — Buying only the features needed without under- or overestimating system requirements.

■ Verified throughput — Demonstrated results of benchmark testing, defined according to RFC 1242.

■ Unfailing reliability — Hot-swapping of boards, redundancy of critical hardware elements such as power supplies, plus painless upgrades.

■ Vendor support — Around-the-clock telephone support, extended service agreements and remote diagnostics or upgrades are essential to keep the network up and running.

Routers

Company	Router	Router type (B = Stand-alone box, P = PC-based, S = Software-only)	Processors: Max. no.	Processors: Upgradable	Forwarding (packet/sec): Ethernet: 64-byte/1.5K-byte packets	Forwarding (packet/sec): Token ring: 64-byte/4.1K-byte packets	Forwarding (packet/sec): FDDI: 64-byte/4.1K-byte packets	Transport protocols: AppleTalk	Transport protocols: DECnet	Transport protocols: ISO CLNP	Transport protocols: IPX	Transport protocols: SNA	Transport protocols: TCP/IP	Transport protocols: XNS	Transport protocols: Other	Inter-router protocols (I = IS-IS, O = OSPF, R = RIP, X = Other)	LAN interfaces: Max. no. of LAN interfaces	LAN interfaces (A = ATM, E = Ethernet, F = FDDI, L = LocalTalk, T = Token ring, X = Other)	WAN interfaces: Max. no. of WAN interfaces	WAN interfaces (A = ATM, F = Frame relay, I = ISDN, P = PPP, S = SMDS, X = Other)	WAN interfaces (1 = T-1, 3 = T-3, 5 = X.25, S = Serial, V = V.35, X = X.21)	SNA support (A = APPN, E = Encapsulation in IP, L = LLC conversion, N = Native SNA, P = Poll spoofing, S = SDLC pass-through)	Bridging (S = Source routing, ST = Source routing transparent, T = Transparent)	Data compression	Mgmt. (C = CMIP/CMIS, N = NetView, P = Proprietary, S = SNMP, X = Other)	Price/warranty (months)
ACSYS, Inc. (800) 462-2797	TokenMaster 1000	B	6			125/2					✔		✔			O	1	T	1	F, X	1, V, X	L, S	T	✔	N, P, S	$2,990/12
	TokenMaster 2000	B	6			3,846/485					✔		✔			O	2	T				L, S	T	✔	N, P, S	$4,690/12
	TokenMaster 4000	B	6			3,846/485					✔		✔			O	1	T	1	F, X	1, V, X	L, S	T	✔	N, P, S	$4,990/12
	TokenMaster 5000	B	6			3,846/485					✔		✔			O	1	T	4	F, X	1, V, X	L, S	T	✔	N, P, S	$5,990/12
Adacom Network Routers, Inc. (214) 386-2400	L2-SR 3000	B	1	✔	(2)	(2)					✔	✔	✔		✔	R, X	2	E, T	8	X	1, 5, S, V,	A, L, N, P, S			N, P	$9,000-$16,000/12
Advanced Computer Communications (800) 444-7854	ACCes/4500 Enterprise Hub	B	20	✔	13K/813	3,600/488	28K/(2)	✔	✔		✔		✔	✔		O, R	40	E, F, T	20	F, P, S	1, 5, S, V, X	L	T	✔	S	$9,990-$108,665/12
	ACS 2100 Bridge/Router 2.0	B	1		10K/813								✔			R	2	E				L	T		S	$3,250/12
	ACS 4100 Bridge/Router 7.0	B	1		1K/813	1K/488		✔	✔		✔			✔		O, R	1	E, T	2	F, P, S	1, 5, S, V, X	L	T		S	$4,950-$6,450/12
	Nile 7.0	B	1		3,500/813	3K/488		✔	✔		✔		✔	✔		O, R	1	E, T	2	F, I, P, S	1, 5, S, V, X	L	S, T	✔	S	$3,750-$5,050/12
	ACS 4200 Bridge Router 7.0	B	1		5K/813	3,600/488		✔	✔		✔		✔	✔		O, R	2	E, T	4	F, P, S	1, 5, S, V, X	L	S, T	✔	S	$5,750-$8,350/12
	ACS 4400 Bridge/Router 7.0	B	4		5K/813	3,600/488		✔	✔		✔		✔	✔		O, R	8	E, T	16	F, P, S	1, 5, S, V, X	L	S, T	✔	S	$5,750-$32,400/12
Alantec Corp. (800) 252-6832	PowerHub Intelligent Switching Hub	B	6		14,880/812		63K/(2)		✔		✔		✔			R	14	E, F					T		S	$9,950-$43,850/12
Amnet, Inc. (508) 879-6306	Nucleus 7400 - IPX Router	P	1	✔	200/150	170/60					✔					X	4	E, T, X	64	F, X	1, V, X	N			P	$7,000/12
Andrew Corp. (800) 733-0331	Pathwise/6200	B	1		4,900/335	3,600/126		✔	✔		✔		✔	✔		O, R	3	E, T	6	F, P, S, X	1, 3, 5, S, V, X	L, N	S, T	✔	P, S	$6,150-$9,700/12
	Pathwise/6511	B	1		4,900/335	3,600/126		✔	✔		✔		✔	✔		O, R	40	E, F, T	20	F, P, S, X	1, 3, 5, S, V, X	N	S, T	✔	P, S	$14,660-$90,337/12
	Pathwise/6505	B	1		4,900/335	3,600/126		✔	✔		✔		✔	✔		O, R	16	E, F, T	8	F, P, S, X	1, 3, 5, S, V, X	N	S, T	✔	P, S	$11,660-$41,335/12
	Pathwise/6002e	B	1		12,500/813								✔			R, X	2	E				N	T		P, S	$3,595/12
	Pathwise/6100	B	1		(6)			✔	✔		✔		✔	✔		O, R	1	E, T	2	F, P, S, X	1, 5, S, V, X	N	S, T	✔	P, S	$4,500-$6,185/12
Apple Computer, Inc. (800) 776-2333	Apple Internet Router	S	1		(4)	(4)	(4)	✔							✔	X	32	E, F, L, T	21	I, S	1, 5, S			✔	S	$499/12
APT Communications, Inc. (301) 831-1182	ComTalk HF	B	1		(3)			✔					✔			R, X	4	E, L							P, S	$1,500-$2,000/24
Ascom Timeplex, Inc. (201) 391-1111	Access Router	B	1		1,400/(2)	3,500/(2)		✔	✔	✔	✔	✔	✔	✔		O, R	4	E, T	5	F, I, P	1, 5, S, V, X	N, S	S, ST, T		S	$3,995-$8,000/12
	Router* Bridge	B	4	✔	14,800/(2)	3,500/(2)	13.5K/(2)	✔	✔	✔	✔	✔	✔	✔		O, R, X	12	E, F, T	12	F, P	1, 5, S, V, X	N, S	S, ST, T		S	$7,500-$35,000/12
Cayman Systems, Inc. (800) 473-4776	GatorBox CS	P	1		(4)			✔	✔		✔		✔			R, X	2	E, L							S, X	$2,795/24
Cisco Systems, Inc. (415) 326-1941	Cisco 7000	B	12		13,978/880	18,306/488	148K/3,050	✔	✔		✔		✔	✔	✔	I, O, R, X	30	E, F, T	40	F, P, S, X	1, 3, 5, V, X	E, S	S, ST, T	✔	S	$19,900/3
	Cisco 4000	B	2		13,263/880	8,033/487		✔	✔		✔		✔	✔	✔	I, O, R, X	6	E, T	6	F, P, S, X	5, S, V, X	E, S	S, ST, T	✔	S, N, X	$4,000 (chassis); $1,800-$3,600 (modules)/3
	Cisco 3000	B	1		5,132/880	(2)		✔	✔		✔		✔	✔	✔	i, O, R, X	2	E, T	3	F, I, P, S, X	5, S, V, X	E, S	S, ST, T	✔	S, N, X	$4,295-$6,995/3
	Cisco 2000	B	1		(4)	(4)		✔			✔		✔			O, R, X	1	E, T	1	F, P, X	5, S, V, X	E	S, T	✔	S, N, X	$3,195-$4,195/3
	Cisco AGS+	B	9	✔	12,763/880	15,486/488	72K/3,050	✔	✔		✔		✔	✔	✔	i, O, R, X	28	E, F, T, X	28	A, F, P, S, X	1, 3, 5, S, V, X	S, L, E	S, ST, T	✔	S, X	$9,900/3

Routers

Company	Router	Router type (B = Stand-alone box, P = PC-based, S = Software-only)	Processors: Max. no.	Processors: Upgradable	Forwarding (packet/sec): Ethernet: 64-byte/1.5K-byte packets	Forwarding (packet/sec): Token ring: 64-byte/4.1K-byte packets	Forwarding (packet/sec): FDDI: 64-byte/4.1K-byte packets	Transport protocols: AppleTalk	Transport protocols: DECnet	Transport protocols: ISO CLNP	Transport protocols: IPX	Transport protocols: SNA	Transport protocols: TCP/IP	Transport protocols: XNS	Transport protocols: Other	Inter-router protocols (I = IS-IS, O = OSPF, R = RIP, X = Other)	LAN interfaces: Max. no. of LAN interfaces	LAN interfaces (A = ATM, E = Ethernet, F = FDDI, L = LocalTalk, T = Token ring, X = Other)	WAN interfaces: Max. no. of WAN interfaces	WAN interfaces (A = ATM, F = Frame relay, I = ISDN, P = PPP, S = SMDS, X = Other)	WAN interfaces (1 = T-1, 3 = T-3, 5 = X.25, S = Serial, V = V.35, X = X.21)	SNA support (A = APPN, E = Encapsulation in IP, L = LLC conversion, N = Native SNA, P = Poll spoofing, S = SDLC pass-through)	Bridging (S = Source routing, ST = Source routing transparent, T = Transparent)	Data compression	Mgmt. (C = CMIP/CMIS, N = NetView, P = Proprietary, S = SNMP, X = Other)	Price/ warranty (months)
	Cisco MGS	B	4	✔	11,528/ 880	11,462/ 488		✔	✔		✔		✔	✔	✔	I, O, R, X	8	E, T	11	P, S, X	S, V, X		S, ST, T	✔	S, N, X	$10,775-$18,000/ 3
Compatible Systems Corp. (800) 356-0283	RISC Router 3000E	B	(2)		14,880/ 812			✔	✔		✔		✔			R, X	4	E, L							P, S	$3,495/ 12
	Ether Route II	B	(2)		190/ (2)			✔								X	3	E, L							P	$1,495/ 12
	Ether Route/TCPII	B	(2)		190/ (2)			✔	✔				✔			R, X	3	E, L							P, S	$1,895/ 12
Coral Network Corp. (800) 424-3579	Backbone Xpress 2000	B	26	✔	14,300/ 805	25K/ 487	160K/ 2,966	✔	✔		✔		✔			O, R	28	E, F, T	28	F, P, X	1, S, V		S, ST, T		S	$25,000-$100,000/ 3
Cray Communications (301) 317-7710 (800) 359-7710	Cray BEX 6800	B	16	✔	14,880/ 627			✔			✔		✔			O, R	20	E, F, T	28	P	1, S, V		S, ST, T		S, X	$17,500-$175,000/ 12
	Cray Remote Router	B	1		10K/ 500				✔	✔	✔		✔			I, R	1	E	8	X	1, 5, S, V, X			✔	P, S	$3,590-$5,375/12
CrossComm Corp. (800) 388-1200	ILAN Universal Router	B	1		5,600/ 430	2,820/ 320					✔		✔			R, X	4	E, T, X	6	F	S	L, N, P, S	S, ST, T	✔	N, P, S	$5,000-$8,000/3
	ILAN jr	B	1		5,600/ 430	2,820/ 320					✔	✔	✔			R, X	4	E, T	1	F, X	1, 5, S, V, X	L, N, P, S	S, ST, T	✔	P, S	$6,000-$8,000/3
	ILAN XL20	B	10	✔	14,880/ 804	10K/ 465		✔	✔		✔	✔	✔	✔	✔	R, X	8	E, T	12	X	1, S, V, X	N, S	S, ST, T	✔	N, P, S	$15,500-$35,000/3
	ILAN XL80	B	40	✔	14,880/ 804	10K/ 465		✔	✔		✔		✔	✔	✔	R, X	32	E, T	48	F, X	1, S, V, X	N, S	S, ST, T	✔	N, P, S	$21,400-$140,000/ 3
Dayna Communications, Inc. (801) 269-7200	Pathfinder	B	1		(2)			✔								X	2	E, L							P	$899/ lifetime
Develcon Electronics, Ltd. (800) 667-9333	Model 300	B	1		7,500/ 340								✔			R, X	1	E, X	2	X	S, V		T	✔	P, S	$2,985-$4,185/ lifetime
Digital Equipment Corp. (800) 344-4825	DECNIS 600 2.2	B	16		13,950/ 812		48K/ 3,050	✔	✔	✔	✔		✔			I, O, R, X	17	E, F	70	F, P	1, 3, 5, S, V, X		T	✔	C, S, P	$15,000-$50,000/ 12
	DECNIS 500 2.2	B	6		13,950/ 812			✔	✔	✔	✔		✔			I, O, R, X	4	E	18	F, P	1, 5, S, V, X		T	✔	C, S, P	$8,750-$14,000/ 12
	DECwanrouter 90	B (1)	1		(4)				✔				✔			I, R	1	E	1	X	5, S, V, X				C	$1,990/12
	DEC wanrouter 250	B	1		(4)				✔	✔			✔			I, R, X	1	E	8	X	S, V				C, S, P	$3,600/12
	DECbrouter 90	B (1)	1		5,300/ 337			✔	✔	✔	✔		✔	✔		I, O, R, X	1	E	2	F, P, S	1, 5, S, V, X	P, S	T		S	$3,240-$4,350/12
D-Link Systems, Inc. (800) 326-1688	Smart Route	B	1	✔	11K/ 790						✔		✔			R	2	E	2	F, P	5, S, V		T		S	$2,895/12
Engage Communication, Inc. (408) 688-1021	Express Router	B	1		(4)			✔					✔			R, X	1	E	2	I	1, S, V, X	S			P, S	$1,995/12
	SyncRouter LT	B	1		(4)			✔								X	1	L	1	I	S, V, X	S		✔	P	$1,595/12
FiberCom, Inc. (800) 537-6801	EAS 8000	B	4		14,880/ 812		156,250 / 2,441				✔		✔			O, R	20	A, E, F	4	A, P	1, 3, S, V		T		S	$6,000-$51,000/ 12
Gateway Communications, Inc. (800) 367-6555	G/Remote Bridge 1.5	P	(4)		160/7	160/25					✔					X	4	E, T, X	6	X	5, V			✔		$1,595/12
	G/Remote Bridge 64	P	(4)		544/2	544/8.5					✔					X	1	E, T, X	6	X	5, V			✔		$2,495/12

Products highlighted by color were selected for The Short List.

FOOTNOTES:
(1) Can be stand-alone or plugged into the DEChub 90.
(2) Information was not available.
(3) Router has 1 Ethernet port and 3 LocalTalk ports. The maximum forwarding rate is 3 times the LocalTalk wire rate.
(4) The forwarding rate varies depending on the PC's or computer system's processing power.
(5) Depends on the number of network interface cards in the PC or computer system.
(6) Forwarding measurements are not applicable between 1 local- and 1 wide-area port.
(7) Router is a board for a multiplexer.

APPN = Advanced Peer-to-Peer Networking
CLNP = Connectionless Network Protocol
CMIP = Common Management Information Protocol
CMIS = Common Management Information Services
IS-IS = Intermediate System to Intermediate System
LLC = Logical Link Control
OSPF = Open Shortest Path First
PPP = Point-to-Point Protocol
RIP = Routing Information Protocol
RISC = Reduced Instruction Set Computing
SMDS = Switched Multimegabit Data Service

SOURCE: MARK MILLER, DIGINET CORP., BROOMFIELD, COLO.

Routers

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Hewlett-Packard Co. (800) 752-0900	HP27287A Router LR	B	1		14,870/ 812			✔	✔		✔		✔	✔		O, R	4	E					T		P, S	$7,500/36
	HP27288A Router SR	B	1		2,285/ 105			✔	✔		✔		✔	✔		O, R	1	E	3	F, I, P, S, X	1, 5, S, V, X	S	T		S	$6,500/36
	HP27289A Router FR	B	1		2,285/ 105			✔	✔		✔		✔	✔		O, R	1	E	1	F, I, P, S, X	1, 5, S, V, X		T		S	$4,500/36
	HP27286A Router TR	B	1		(2)	4,689/ 811		✔	✔		✔	✔	✔	✔		O, R	2	E, T	2	F, I, P, S, X	1, 5, S, V, X	S	S, ST, T		S	$6,500/36
	HP27290A Router BR	B	1		14,845/ 812		14,880/ (2)	✔	✔		✔		✔	✔		O, R	4	E, F					T		S	$12,500/ 36
	HP27285A Router ER	B	1		7,744/ 812			✔	✔		✔		✔	✔		O, R	2	E	2	F, I, P, S, X	1, 5, S, V, X	S	T		S	$6,500/36
Hughes Network Systems (301) 601-4299	PCrouter	P	1		500/ 100	500/50					✔		✔			R	1	E, T	2		5, V, X				S	$2,695/3
	LANswitch	B	2		7K/6K						✔		✔			R	4	E	10	F	V, X		T		S	$7,000-$19,000/3
IBM (914) 642-4032	IBM 6611 Network Processor	B	17		4,349/ 810	3,903/ 496		✔	✔		✔	✔	✔	✔	✔	O, R, X	7	E, T	14	F, P, X	1, 5, S, V, X	E, S	S, T		S	$6,195-$12,340/ 12
IDEA (800) 257-5027	IDEA Concert BRouter	B	4		2,819/ 106	3K/47					✔	✔	✔			R, X	4	E, T	8	X	1, S, V, X	E	S, T		P, S	$4,750-$12,250/ 12
	IDEA comm BRouter	P	1		2,819/ 106	3K/47					✔		✔			R, X	1	E, T, X	2	X	1, S, V, X	E	S, T		P, S	$2,495-$2,995/12
Madge Networks, Inc. (800) 876-2343	Smart 16/4 Bridgenodes	P	1	✔		19,500/ 265		✔		✔	✔		✔			I, O, R, X	6	T	24	P	1, 5, S, V, X	N	S		S, X	$1,045-$1,395/60
Microcom, Inc. (800) 822-8224	Microcom Bridge/Router (MBR)/6000	P	5		(6)						✔		✔			R	1	E, T	4	X	1, V, X		S, ST, T	✔	P, S	$4,299-$9,599/12
	MBR/6500	P	5		(6)						✔		✔			R	1	E, T	4	F	5, X, V		S, ST, T	✔	P, S	$4,299-$9,599/12
NEC America, Inc. (800) 222-4632	Dr. BonD	B	3		2,210/ 450						✔		✔			R	40	E	36	P, X	1, S, V	E		✔	P, S, X	$3,090-$6,500/12
Network Application Technology, Inc. (800) 543-8887	LANB/290 Remote IP Router	B	1		2,478/ 109						✔		✔			R	1	E	1	P, X	1, S, V, X		T		S	$1,895-$1,995/12
	LANB/295 Multi-Protocol Router	B	1		2,478/ 109						✔		✔			R	1	E	2	P	1, S, V, X		T	✔	S	$1,895-$1,995/12
Network Automation (508) 393-1777	Work Station Interface Node	P	2	✔	(4)	(4)	(4)		✔		✔	✔	✔			R	(5)	E, F, L, T	3	A, F, I, P, X	1, 5, S, V, X	E, S			C, N, P, S, X	$3,000/6
Network Equipment Technologies, Inc. (415) 366-4400	LAN/WAN Exchange	(7)			6,665/ (2)	1,870/ (2)		✔	✔		✔	✔	✔	✔	✔	I, O, R, X	1	E, T	8	F, I, P, S, X	1, 3, 5, S, V, X	E, L, P	S, T		P, S	$8,000-$11,000/ 12
Network Express, Inc. (313) 761-5005	NE ISDN InterHub	B	8	✔	(2)								✔			R	1	E	32	I, P			T		P, S	$9,600-$22,100/ 12
	NE ISDN Router	B	8	✔	(2)								✔			R	2	E	32	I, P, X	1, S, V	S	T		P, S	$6,500-$22,100/ 12
Network Resources Corp. (408) 383-9300	Multigate Hub 2	B	1		11,347/ 813			✔			✔		✔			O, R	3	E, L	3	P, X	1, S, V		T		S	$4,500-$10,000/ 36
	Multigate Hub 1W	B	1		11,347/ 813			✔			✔		✔			O, R	2	E	2	P, X	1, S, V		T		S	$2,500-$3,695/36
Network Systems Corp. (612) 424-4888	6400	B	12		14,880/ 800	3,600/ 486	9K/ 2,548	✔	✔		✔	✔	✔	✔		O, R	16	E, F, T, X	16	A, F, P, S, X	1, 3, 5, S, V	E, L	S, ST, T		P, S	$9,500-$30,000/ 3.5
	6800	B	30		14,880/ 800	3,600/ 486	9K/ 2,548	✔	✔		✔	✔	✔	✔		O, R	28	E, F, T, X	32	A, F, P, S, X	1, 3, 5, S, V	E, L	S, ST, T		P, S	$15,500-$60,000/ 3.5
	6600	B	1		14,880/ 812	3,600/ 486	18K/ (2)	✔	✔		✔	✔	✔	✔		R	4	E, F, T	4	F, P, S	1, 5, S, V	L, N	S, T		N, S	$4,995-$17,000/ 3.5
Networks Northwest, Inc. (206) 641-8779	BReeze 1000	B	1		155/7						✔		✔			R	1	E	1	P, X			S, ST	✔	S	$2,950/12
	BReeze 1100	B	1		155/6						✔		✔			R	1	E	1	X			S, ST	✔	S	$2,650/12
	BReeze 1200	B	1		341/14						✔		✔			R	1	E	1	F, I, P			S, ST	✔	S	$2,650/12
Newbridge Networks, Inc. (703) 834-3600	8231 MainStreet Ethernet Router	B	1		(6)			✔	✔		✔		✔	✔		O, R	1	E	4	F, P, X	1, 5, S, V, X		T	✔	S	$4,500-$7,500/12

Routers

Company	Router	Router type (B = Stand-alone box, P = PC-based, S = Software-only)	Processors: Max. no.	Processors: Upgradable	Forwarding (packet/sec): Ethernet: 64-byte/1.5K-byte packets	Forwarding (packet/sec): Token ring: 64-byte/4.1K-byte packets	Forwarding (packet/sec): FDDI: 64-byte/4.1K-byte packets	Transport protocols: AppleTalk	DECnet	ISO CLNP	IPX	SNA	TCP/IP	XNS	Other	Inter-router protocols (I = IS-IS, O = OSPF, R = RIP, X = Other)	LAN interfaces: Max. no. of LAN interfaces	LAN interfaces: A = ATM, E = Ethernet, F = FDDI, L = LocalTalk, T = Token ring, X = Other	WAN interfaces: Max. no. of WAN interfaces	WAN interfaces: A = ATM, F = Frame relay, I = ISDN, P = PPP, S = SMDS, X = Other	WAN interfaces: 1 = T-1, 3 = T-3, 5 = X.25, S = Serial, V = V.35, X = X.21	SNA support (A = APPN, E = Encapsulation in IP, L = LLC conversion, N = Native SNA, P = Poll spoofing, S = SDLC pass-through)	Bridging (S = Source routing, ST = Source routing transparent, T = Transparent)	Data compression	Mgmt. (C = CMIP/CMIS, N = NetView, P = Proprietary, S = SNMP, X = Other)	Price/warranty (months)
	8251 MainStreet Token Ring Router	B	1			(6)		✔	✔		✔	✔	✔	✔		O, R	1	T	4	F, P, X	1, 5, S, V, X	S	S, ST, T	✔	S	$4,500-$7,500/12
Newport Systems Solutions, Inc. (800) 368-6533	LAN^{2}LAN/ Multiprotocol Router 3.0	P	(4)	✔	14,728/800	(2)					✔		✔			R	4	E, T	12	I, P, X	1, 5, V, X		T	✔	P, S	$995-$3,995/24
Niwot Networks, Inc. (303) 444-7765	Novell Router Node	P	1	✔	(4)	(4)					✔					R	4	E, T, X	4	I	1, S, V, X			✔		$1,390-$1,490/12
	PC Route Node	P	1	✔	(4)	(4)							✔				1	E, T, X	1	I, X	1, S, V, X			✔		$790/12
Novell, Inc. (800) 638-9273	NetWare Multi Protocol Router 2.1	S	1		11,104/725	15,082/496	18.5K/2,060	✔		✔	✔		✔			I, R	16	E, F, L, T, X	16	I, P, X	1, 5, V, X		S		S, X	$995-$1,495/3
OST, Inc. (703) 817-0400	Magellys	P	4		(2)								✔			(2)	1	E	6	I	5, X				S	$3,995-$5,000/12
	LanXpand-Inter/NW	P	5	✔	(2)	(2)					✔					(2)	1	E, T		I	5, X					$1,995/12
	MacSnet Link	P	5		(2)	(2)		✔								(2)	(2)	E, L, T	4	I				✔		$1,595/12
Penril Datability Networks, Inc. (301) 921-8600	BRX7250	B	7	✔	14,880/(2)										✔	O, R, X	20	E		X	1, V		T		S	$2,700/12
	BRX7200	B	6	✔	14,880/811										✔	O, R, X	20	E	20	X	V		T		S	$11,950/12
	BRX5621	B	1	✔	14,880/811			✔			✔		✔	✔		R, X	2	E	1	F, P	5, V		T		S	$4,799/12
	BRX2500	B	1	✔	14,880/(2)			✔								R, X	1	E	8		S		T		S	$2,999/12
	BRX5810	B	1	✔	14,880/(2)		(2)	✔	✔	✔	✔	✔	✔	✔	✔		1	E, F					T		S	$11,995/12
	BRX5641	B	1	✔	14,880/811		(2)	✔			✔		✔	✔		R, X	4	E, F	1	F, P	5, V		T		S	$5,999/12
	BRX7400	B	9	✔	14,880/811			✔			✔		✔	✔		R, X	16	E	18	F, P	5, V		T		S	$1,000/12
Plexcom, Inc. (805) 522-3333	8028 SA	B	2		14,880/825			✔	✔	✔	✔	✔	✔	✔	✔	R	1	E	1	A, F, P	1, 5, S, V, X	A, L	T	✔	P, S	$5,995-$10,000/12
Proteon, Inc. (508) 898-2800	Corporate Network Exchange (CNX) 600 Bridging Router	B	7	✔	14,800/880	13,800/450	44K/1,587	✔	✔		✔		✔	✔	✔	I, O	10	E, F, T	20	F, P, X	5		S, ST, T		S	$16,900-$22,500/12
	CNX 500 Bridging Router	B	4		14,800/880	13,800/450	22K/1,587	✔	✔		✔		✔	✔	✔	I, O	6	E, F, T	12	F, P, X	5		S, ST, T		S	$9,995-$14,235/12
	CNX 400 Bridging Router	B	2		14,800/880	13,800/450	22K/1,587	✔	✔		✔		✔	✔	✔	I, O	3	E, F, T	6	F, P, X	5		S, ST, T	✔	S	$3,995-$16,000/12
	Department Network Exchange (DNX) 300n Bridging Router	B	1		(2)						✔		✔			O	2	E	2	F, P, X	5		T		S	$3,995-$5,495/12
	DNX 300m Bridging Router	B	1		(2)	(2)		✔	✔		✔		✔	✔	✔	I, O	2	E, T	2	F, P, X	5		S, ST, T		S	$4,995-$7,995/12
RAD Network Devices, Inc. (714) 891-1446	OpenGate OG-C12		13		14,400/820	25K/480	35K/(2)		✔		✔	✔	✔			O, R	52	E, F, T	26	X	1, S, V, X	L	S, ST, T		S	$10,000-$30,000/12
	OpenGate OG-C4		4		14,400/820	25K/480	35K/(2)		✔		✔	✔	✔			O, R	16	E, F, T	8	X	1, S, V, X	L	S, ST, T		S	$5,000-$15,000/12
	OpenGate OG-MAR		1		14,400/820	25K/480	35K/(2)		✔		✔	✔	✔			O, R	1	E, F, T	2	X	1, S, V, X	L	S, ST, T		S	$3,995-$4,995/12
Retix (800) 255-2333	4941 Remote Bridge/Router	B	2		8K/800				✔		✔		✔			R	1	E	1	X	1, 5, S, V, X		T	✔	S, X	$4,450/12
	4942 Remote Bridge/Router	B	2		8K/800				✔		✔		✔		✔	R	1	E	2	X	1, 5, S, V, X		T	✔	S, X	$4,950/12
	4982 Remote Bridge/Router	B	2		8,600/800				✔		✔		✔		✔	R	1	E	2	X	1, 5, S, V, X		T	✔	S, X	$5,950/12
	4760 Local Bridge Router	B	1		13,650/800								✔		✔	R	2	E					T		S, X	$3,250/12
	RouterXchange (RX) 7000 Model 7500	B	5	✔	14,880/813	3K/450	30K/3K		✔		✔		✔		✔	O, R	12	A, E, F, T	12	A, F, I, P, X	1, 5, S, V, X		S, ST, T	✔	S, X	$9,200-$30,000/12
	RX 7000 Model 7550	B	5	✔	14,880/813	3K/450	30K/3K		✔		✔		✔		✔	O, R	12	A, E, F, T	12	A, F, I, P, X	1, 5, S, V, X		S, ST, T	✔	S, X	$11,200-$32,000/12

Routers

Company	Router	Router type (B = Stand-alone box, P = PC-based, S = Software-only)	Processors: Max. no.	Processors: Upgradable	Forwarding (packet/sec): Ethernet: 64-byte/1.5K-byte packets	Forwarding (packet/sec): Token ring: 64-byte/4.1K-byte packets	Forwarding (packet/sec): FDDI: 64-byte/4.1K-byte packets	Transport protocols: AppleTalk	DECnet	ISO CLNP	IPX	SNA	TCP/IP	XNS	Other	inter-router protocols (I = IS-IS, O = OSPF, R = RIP, X = Other)	LAN interfaces: Max. no. of LAN interfaces	LAN interfaces: A = ATM, E = Ethernet, F = FDDI, L = LocalTalk, T = Token ring, X = Other	WAN interfaces: Max. no. of WAN interfaces	WAN interfaces: A = ATM, F = Frame relay, I = ISDN, P = PPP, S = SMDS, X = Other	WAN interfaces: 1 = T-1, 3 = T-3, 5 = X.25, S = Serial, V = V.35, X = X.21	SNA support (A = APPN, E = Encapsulation in IP, L = LLC conversion, N = Native SNA, P = Poll spoofing, S = SDLC pass-through)	Bridging (S = Source routing, ST = Source routing transparent, T = Transparent)	Data compression	Mgmt. (C = CMIP/CMIS, N = NetView, P = Proprietary, S = SNMP, X = Other)	Price/warranty (months)
	RX 7000 Model 7250	B	2	✔	14,880/813	3K/450			✔		✔		✔		✔	O, R	3	A, E, T	3	A, F, I, P, X	1, 5, S, V, X		S, ST, T	✔	S, X	$6,200-$15,000/12
Rockwell International Corp. CMC Network Products (800) 262-8023	NetHopper Dialup Routers	B	1		(6)						✔		✔			R	1	E	1	P	S			✔	S	$1,695-$3,495/12
Standard Microsystems Corp. (800) 762-4968	Elite Switching Hub ES/1	B	12		14,880/812	4K/100	60K/3,050				✔		✔			O, R	20	E, F, T	5	P	V		S, ST, T		S	$17,200-$32,850/12
Systems Strategies, Inc. (212) 279-8400	Express IP Router	S	(4)		(2)	(2)	(2)					✔	✔			X	(5)	E, F, T, X	16	X	5, V	A, N			N, P	$700-$4,000/12
Telco Systems, Inc.'s Magnalink Communications Division (617) 255-9400	Series 3000 Compression Bridge/Router	B	1	✔	2,500/800	(2)					✔		✔			O, R	1	E, T	4	F, X	1, S, V		S, T	✔	P, S	$6,000/12
3Com Corp. (408) 764-5000	NetBuilder II	B	1		14,880/823	3,900/488	64K/3K	✔	✔	✔	✔	✔	✔	✔	✔	I, O, R	16	E, F, T	8	F, I, P, S, X	1, 5, S, V, X	A, E, L, P	S, ST, T	✔	S	$10,495-$30,000/12
	NetBuilder Remote	B	1		3K/168			✔	✔		✔	✔	✔	✔	✔	I, O, R	2	E	2	F, I, P, S	1, 5, S, V, X	A, E, L, S	S, ST, T	✔	S	$7,245/12
	NetBuilder Token Ring Remote	B	1			3,850/600		✔	✔		✔	✔	✔	✔	✔	I, O, R	2	T	2	F, I, P, S	1, 5, S, V, X	A, E, L, S	S, ST, T	✔	S	$11,245/12
	NetBuilder Remote Control	B	1		3K/168			✔	✔		✔	✔	✔	✔	✔	I, O, R	1	E	1	F, P, S	1, 5, S, V, X	A, E, L, S	S, ST, T	✔	S	$3,495/12
	NetBuilder Remote Access	B	1		3K/168			✔	✔		✔	✔	✔	✔	✔	I, O, R	1	E	1	F, P, S	1, 5, S, V, X	A, E, L, S	S, ST, T	✔	S	$4,995/12
	NetBuilder Token Ring Remote Access	B	1			3,850/600		✔	✔		✔	✔	✔	✔	✔	I, O, R	1	T	1	F, P, S	1, 5, S, V, X	A, E, L, S	S, ST, T	✔	S	$6,995/12
	NetBuilder Token Ring Remote Control	B	1			3,850/600		✔	✔		✔	✔	✔	✔	✔	I, O, R	1	T	1	F, P, S	1, 5, S, V, X	A, E, L, S	S, ST, T	✔	S	$5,995/12
Wellfleet Communications, Inc. (508) 670-8888	Access Feeder Node	B	1		14,500/811	6,346/496		✔	✔	✔	✔	✔	✔	✔		I, O, R	2	E, T	2	F, P, S, X	1, 5, S, V, X	S	S, T		S	$5,995/3
	Access Link Node	B	2		14,500/811	6,346/496		✔	✔	✔	✔	✔	✔	✔		I, O, R	2	E, T	2	F, P, S, X	5, S, V, X	S	S, T		S	$11,500/3
	Feeder Node	B	1	✔	14,500/811	6,346/496		✔	✔	✔	✔	✔	✔	✔		I, O, R	4	E, T	4	F, P, S, X	5, S, V, X	S	S, T		S	$6,995/3
	Link Node	B	4	✔	14,500/811	6,346/496	30K/1,830	✔	✔	✔	✔	✔	✔	✔		I, O, R	16	E, F, T	16	F, P, S, X	1, 5, S, V, X	S	S, T		S	$6,750/3
	Concentrator Node	B	13	✔	14,500/811	6,346/496	30K/1,830	✔	✔	✔	✔	✔	✔	✔		I, O, R	52	E, F, T	52	F, P, S, X	1, 5, S, V, X	S	S, T		S	$15,000/3
	Backbone Link Node	B	4		14,500/811	21,200/485	88K/2,435	✔	✔		✔	✔	✔	✔	✔	O, R	16	E, F, T	16	F, P, S, X	1, 5, S, V, X	S	S, T		S	$12,000/3
	Backbone Concentrator Node	B	13		14,500/811	21,200/485	88K/2,435	✔	✔		✔	✔	✔	✔	✔	O, R	52	E, F, T	52	F, P, S, X	1, 5, S, V, X	S	S, T		S	$24,000/3
Xyplex, Inc. (800) 338-5316	MX-6220 Standalone Remote Router	B	1		8,480/(2)			✔	✔		✔		✔			O, R, X	1	E	2	F, P, X	1, 5, S, V, X		T		S	$3,995/36
	MX-3210 Standalone Bridge/Router	B	1		8,480/(2)			✔	✔		✔		✔			O, R	2	E					T		S	$3,695/36

Products highlighted by color were selected for The Short List.

FOOTNOTES:
(1) Can be stand-alone or plugged into the DEChub 90.
(2) Information was not available.
(3) Router has 1 Ethernet port and 3 LocalTalk ports. The maximum forwarding rate is 3 times the LocalTalk wire rate.
(4) The forwarding rate varies depending on the PC's or computer system's processing power.
(5) Depends on the number of network interface cards in the PC or computer system.
(6) Forwarding measurements are not applicable between 1 local- and 1 wide-area port.
(7) Router is a board for a multiplexer.

APPN = Advanced Peer-to-Peer Networking
CLNP = Connectionless Network Protocol
CMIP = Common Management Information Protocol
CMIS = Common Management Information Services
IS-IS = Intermediate System to Intermediate System
LLC = Logical Link Control
OSPF = Open Shortest Path First
PPP = Point-to-Point Protocol
RIP = Routing Information Protocol
RISC = Reduced Instruction Set Computing
SMDS = Switched Multimegabit Data Service

SOURCE: MARK MILLER, DIGINET CORP., BROOMFIELD, COLO.

Routers set to eclipse bridges

One of the most significant trends in the last year has been the emergence of low-end routers, designed to serve a single remote office.

This market has become the next battleground in the internetworking arena, says Jay Batson, an analyst at Forrester Research, Inc. in Cambridge, Mass. "By early 1992, the headquarters of many large internets had been designed, and the ink was already dry on the high-end router contracts."

Vendors then turned their attention to remote offices, defined as sites with a maximum of four local-area networks and perhaps as many as 40 workstations, as the next marketing frontier.

As a result, low-end routers appear poised to displace bridges at remote sites.

"The low-cost, plug-and-play nature of the bridge is comforting," says John Vega, product manager at Hewlett-Packard Co.'s Roseville Networks Division. "Providing a multiprotocol router sounds, and is, more complex. You must, therefore, convince the user that the router will not fail more often due to the complexity."

Matthew Moran, a systems programmer for the county of Santa Barbara, Calif., looked to Novell, Inc.'s low-end, software-based router as the basis for its internetworking solution. The county's internetwork includes Internet Protocol and Internetwork Packet Exchange (IPX) protocols, plus Systems Network Architecture traffic, which must be source route bridged, not routed. "With more than 40 token rings scattered over 30 locations, each with its own NetWare server, we already had a considerable investment in file server hardware," Moran says. "As a government organization, we simply could not afford to add full-blown routers to each of these rings."

Moran opted to place a multiport router at the administration building and incorporate Novell's routing software along with the file and print service in each outlying file server. No performance problems have been noted, but the option to move the router function to a separate hardware platform is always open should if needed. Since our analysts were already familiar with NetWare, they didn't have to learn the intricacies of yet another piece of software."

Dr. Steven Erde, director of academic computing at Cornell University Medical College in New York, has used Compatible Systems Corp.'s RISC Router 3000 products for his multiprotocol, multilocation environment.

"While we have several high-end routers installed, this explosive growth dictated that we get a big bang for our bucks," Erde says. "These low-end [Reduced Instruction Set Computing] routers proved to be a good balance between cost and performance." Medical images, requiring up to 500K bytes each of bandwidth, comprise some of Cornell's internetwork traffic. "Even when stressed with these large files, these low-end devices have performed to our satisfaction," he adds.

BY MARK A. MILLER

Continued from page 44

at the periphery with a low-end box — depends on the specific internetwork requirements.

Joe Furgerson, 3Com's product line manager for remote office internetworking, looks at both WAN and LAN requirements. "People managing WANs are managing the very significant costs of WAN utilization and ongoing administration. People managing LANs are concerned with reliability, performance and future-proofing. The challenge is to make sure the router is not the bottleneck and has maximum uptime."

For either low- or high-end designs, the fact remains that the router is more complex than its bridge counterparts. Bridges forward a frame from one LAN segment to another based on the local addresses, defined at the Open Systems Interconnection data link layer. These addresses reside in the LAN workstation in read-only memory. Routers, operating at the OSI network layer, use internetwork addresses, which are assigned by the network administrator. While the additional layer adds to the devices' complexity, it also provides for more intelligent routing decisions.

Three generations of routers have passed through the internetworking industry in the past few years. First-generation devices, developed in the late 1980s, were placed in either a local or remote configuration and were designed to support a specific LAN interface and protocol combination, such as Ethernet and DECnet. Second-generation routers, which emerged in the early 1990s, integrated local or remote configurations, added multiple LAN and WAN interfaces, multiple protocols and some degree of redundancy. Third-generation devices available today are a quantum step above their predecessors, with modular architectures that provide easy migration paths to

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new technologies, multiple interfaces to support every conceivable LAN or WAN interface, and custom processors for higher packet throughput among their attributes. These product features, plus much more, are shown in the Buyer's Guide chart beginning on page 45.

Routers come in three varieties: a standalone, proprietary box; a personal computer-based platform; or software-only offerings that are loaded onto a PC or an Apple Computer, Inc. Macintosh. High-end routers require the proprietary design to provide a flexible mixture of LAN and WAN interfaces with maximum throughput. PC- and software-based units fall at the mid- to low-end of the spectrum, using the falling prices of standard hardware components to assist their price/performance ratios. Vendors in the PC-based category include Amnet, Inc., Cayman Systems, Inc., Gateway Communications, Inc., Hughes Network Systems, IDEA, Madge Networks, Inc. and Microcom, Inc. Software-only solutions are provided by Apple, Novell and Systems Strategies, Inc.

Routers have three key architectural elements: a packet processing engine; control software supporting configuration, management and fault-recovery functions; and the LAN or WAN interfaces. These elements — especially the number and type of buses and processors — plus the location of those processors (either at the interface, attached to the bus or both), all factor into the router's performance.

Buyers beware: These packet processors perform two distinct functions. Many vendors focus solely on the number of processors a router offers, but that obfuscates the truth. In reality, some of those processors may reside on LAN/WAN interface boards and do some media access control layer processing. Meanwhile, the bulk of the real packet processing takes place in the device's packet engine. To merely compare one router to another on the basis of the total number of processors does not go far enough in the analysis.

An apples-to-apples comparison of routers starts by looking at the core architecture, which may be a centralized or a distributed design. Coral Network and Cisco prefer a centralized approach, which places all of the routing horsepower, buffering and memory functions in one location, usually a central processing engine. These vendors claim superior cost/performance ratios and tout the design's ability to accommodate upgrades with ease.

In contrast, Wellfleet has adopted more of a symmetric multiprocessing approach in which it distributes the routing function to each interface card that resides in the router. As additional interfaces are added, more routing horsepower is added, as well. Wellfleet claims this approach provides superior scalability by adding functionality in small incremental steps.

Router buyers must look beyond the vendor's architecture hype and consider other factors that impact router performance. Walt Jones, vice president of engineering for Coral Network, advises router customers to consider four architectural attributes. First, maximum transmission rate performance at all link speeds is essential. For example, if the device has an FDDI interface, it should be able to process packets on that interface at its maximum rate — 100M bit/sec.

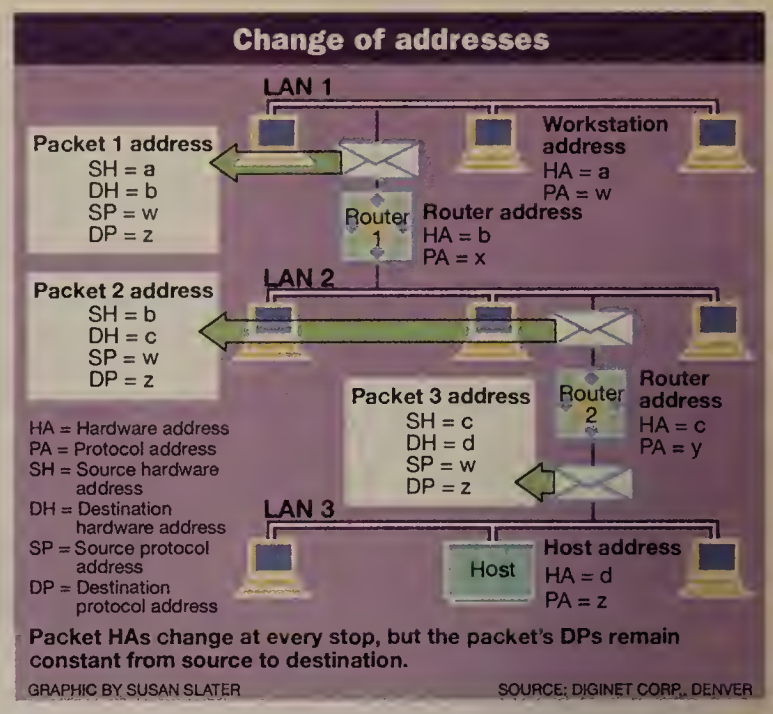
Support for LAN and WAN interfaces is wide ranging in today's router products, with a varying number of ports and media types available. On the LAN side, FDDI support is available from most vendors. Asynchronous Transfer Mode (ATM) LAN interfaces are not as common, with only FiberCom, Inc.'s EAS 8000 and Retix's RouterXchange models providing support for this emerging technology.

ATM on the WAN side is much more popular, with Cisco, FiberCom, Network Automation, Network Systems Corp., Plexcom, Inc. and Retix indicating this support. Frame relay and Point-to-Point Protocol support is quite common, with Switched Multimegabit Data Service supported by 3Com, Advanced Computer Communications, Andrew Corp., Cisco, DEC, Hewlett-Packard Co., Network Equipment Technologies, Inc., Network Systems and Wellfleet.

Secondly, the aggregate throughput of the router becomes a vital measurement of its processing power — how many packets per second can the router transfer in from the interfaces, across the bus and out to other interfaces without dropping any. Aggregate throughput in the range of 800M bit/sec to 1G bit/sec is not uncommon in today's router products.

The throughput of the router may also be affected by the number of media-type conversions it must make. For example, the conversion from an incoming ATM interface to an outgoing ATM interface would not require any media conversions if the router's backplane is ATM-based. If the router backplane uses a high-speed, proprietary bus, two packet conversions — both into and out of the switching element — would be required.

Jones views the presence of ATM on the router as being a key attribute at the interface level but not necessarily on the backplane. "Customers planning to deploy ATM in a private backbone network should look for ATM support at the interface first and on the backplane second," he says. Support at the interface will assure that a "fork-lift upgrade" (a wholesale change of the hardware platform) will not be required once ATM is installed. The advantage of ATM on the backplane is for ATM-to-ATM connections, where no media conversions are required. So for users that may



Packet HAs change at every stop, but the packet's DPs remain constant from source to destination.
GRAPHIC BY SUSAN SLATER
SOURCE: DIGINET CORP., DENVER

The Short List

Routers

The Short List highlights products that Network World *recommends you examine during the purchasing process for routers. Products named in The Short List for routers provide useful and unique features that set them apart from other offerings that may meet all of the Buyer's Guide selection criteria.*

■ **Cisco Systems, Inc.**'s router product line stands out for its product diversity across the low, middle and high ends of the router market. The low-end Cisco 2000, designed for the branch office market, sports a reasonable price tag of $3,195. The high-end Cisco 7000 allows up to 30 local- and 40 wide-area network ports, supporting Ethernet, Fiber Distributed Data Interface, token ring, frame relay, Switched Multimegabit Data Service (SMDS), T-1 and T-3 interfaces.

Most notable about Cisco's products are their wide-ranging protocol support. Transport protocols include AppleTalk, VINES, DECnet, IPX and Transmission Control Protocol/Internet Protocol. Systems Network Architecture support includes Synchronous Data Link Control conversion and SNA encapsulation in TCP/IP. Interrouter protocols include such mainstays as the Routing Information Protocol (RIP) Open Shortest Path First (OSPF), Intermediate System to Intermediate System (IS-IS), the Border Gateway Protocol and Exterior Gateway Protocol, plus Cisco's own Interior Gateway Routing Protocol.

■ **Coral Network Corp.'s Backbone Xpress 2000** typifies the high-end router market. High reliability is the cornerstone of Coral's architecture, which includes redundancy of power supplies, bus, switch and line ports, and hot-swappability of defective modules.

As many as 28 LAN or WAN ports may be configured with interfaces for Ethernet, FDDI and token-ring LANs, as well as frame relay, T-1 and Point-to-Point Protocol (PPP) WAN connections. AppleTalk, DECnet, Internetwork Packet Exchange (IPX) and TCP/IP transport protocols are supported, along with RIP and Open Shortest Path First (OSPF) interrouter protocols.

Bridging is also incorporated into the architecture with support for source routing, transparent and source routing transparent algorithms. Network management support is provided using Simple Network Management Protocol. Coral's architecture and its high level of built-in redundancy has set a new standard for high performance in mission-critical applications.

The one drawback, however, is price; Coral's Backbone Express 200 sells for between $25,000 and $100,000.

■ **Hewlett-Packard Co.**'s router family ranges in price from $4,500 to $12,500 and includes one feature that competitors should copy — a three-year, on-site limited warranty. But don't expect to need that warranty soon because HP claims that both the HP27290A Router BR model (supporting FDDI) and HP27287A Rourter LR model (supporting Ethernet) have a mean time between failure of more than 12 years. Ethernet throughput for these two models is at the theoretical maximum.

Models in the product family support from one to four LAN ports with a maximum of three WAN connections. Network management support, via HP's OpenView, is also strongly integrated into the product line.

■ **IBM's 6611 Network Processor** provides a link from present legacy networks to the future by integrating SNA, Advanced Peer-to-Peer Networking and Network Basic I/O System nets. The 6611 can handle as many as seven Ethernet or token-ring interfaces and up to 14 WAN interfaces, including frame relay. Protocol support includes AppleTalk, DECnet, IPX, TCP/IP and Xerox Network Systems, plus SNA support with Data Link Switching and SDLC-to-Logical Link Control 2 conversion.

It can also function as a multiport source routing or transparent bridge. An SNMP agent allows the 6611 to be integrated with multiprotocol management platforms or managed by IBM's NetView.

■ **Novell, Inc.**'s NetWare Multi Protocol Router 2.1 provides a low-cost, software-only router and source routing bridge. With Ethernet throughput measured at over 11,000 packet/sec. for 64-byte packets, the router's performance compares with much more expensive devices. The software supports up to a combination of 20 LAN and WAN interfaces, including Arcnet, Ethernet, FDDI, LocalTalk and token ring on the LAN side, and Integrated Services Digital Network, T-1 and PPP interfaces to WANs.

Most notable in a low-end product is its multiprotocol support for AppleTalk, International Standards Organization Connectionless Network Protocol, IPX and TCP/IP transport protocols, plus RIP and IS-IS interrouter protocols. Network management functions are supported by NetWare utilities and an SNMP agent.

■ **Wellfleet Communications Inc.**'s router family, with its distributed packet processing architecture, achieves consistent, outstanding performance results at low, middle and high ends of the product spectrum. With only a few exceptions, all the protocols supported on low-end products are also offered on the high end.

The number of supported interfaces scales from 2 to 52 and includes frame relay and SMDS interfaces for all elements of the product line. Network management includes SNMP support, plus two customized tools — the Site Manager, which allows remote software updates and configuration changes; and Technician Manager, a terminal-based tool for local or remote installation and maintenance functions.

extend ATM down to LANs, a router with an ATM backplane would be preferred. For other connections, such as FDDI to ATM, the processing power of the routing engine — no matter what its architecture — is the key factor.

Users planning a transition to ATM may have to wait a while for an ATM-based router backplane, as none of the vendors surveyed indicated current support for this type of backplane technology. Proprietary buses continue to dominate this industry.

Finally, the key role that the router plays in overall network availability must be a key consideration. "Fault tolerance is becoming the single hottest issue," Jones says. "Power supply redundancy can no longer be the sole fault-tolerant feature. Complete redundancy for all modules, at both the system and network interface level, is required." Hot-swappability of these modules, plus built-in administration and network management features, are other items worth considering. Coral Network's Backbone Xpress 2000, for example, has the ability to internally reconfigure around a failed interface in a matter of a few seconds. This prevents the interrouter protocols, such as OSPF, from recognizing and broadcasting the failure to other parts of the internetwork. Fast recoveries keep the network performance high, by eliminating the congestion that would occur around a failed router.

Know your protocols

Operating a router-based internetwork requires consistent network layer protocols, which come in two varieties. Internetwork addressing functions must be considered by using such protocols as the Internet Protocol, Novell, Inc.'s Internetwork Packet Exchange (IPX) or Digital Equipment Corp.'s DECnet Routing Protocol.

In addition, users must adopt a protocol to communicate the status of wide-area network links or routing tables among the different routers. The Routing Information Protocol (RIP), Open Shortest Path First (OSPF) and Open Systems Interconnection Intermediate Station to Intermediate Station (IS-IS) are used for these functions.

While the network layer protocols, such as IP or IPX, are largely dictated by the applications and operating system and, thus, not open to debate, the interrouter protocols are a different story. These protocols are used by the routers to exchange internetwork topology information and store that information in a table. Since each vendor's table structures are proprietary, the method for communicating this information may be specific to that product's implementation, as well.

Two classes of interrouter protocols have been developed, and they are designated by their respective algorithms: distance vector (DVA) and link state (LSA).

DVAs are so named because each router's table must contain the distance between itself and any other node in the internetwork. DVAs exchange their routing tables with their neighbors. Each router selects the best routes from the tables it receives. However, that router must introduce delays in accepting new routes so routing loops are not created. This attribute may also create delays in routing around failures — a problem that is referred to as slow convergence.

RIP, which is used in IP-based internetworks, is an example of a DVA-based protocol. It is typically used with smaller networks, such as those with fewer than 15 hops.

LSAs cause each router to have a map of the entire network. Each router generates its routing table from the map. When a change occurs, each router synchronizes its map with the others. This technique consumes additional memory and processing time, but results in faster convergence. OSPF is an example of an LSA-based protocol. It is more complex than RIP, but allows a large network to be subdivided into smaller areas, thus reducing the amount of interrouter traffic.

Some vendors choose proprietary — instead of industry-standard — interrouter protocols to enhance this communication. For example, Cisco Systems, Inc.'s Interior Gateway Routing Protocol (IGRP) is a protocol that allows greater routing flexibility. Cisco has techniques that allow information exchange between IGRP and other IP routing protocols such as OSPF, IS-IS and RIP. This lets network administrators use equipment from different vendors and select the protocol that best suits each portion of the network.

Cisco has announced enhancements to IGRP that allow it to combine the benefits of DVA and LSA protocols. Enhanced IGRP combines the fast convergence of a link state protocol with the ease of use of a distance vector protocol. In addition, it can support three different network layer protocols: IP, AppleTalk and IPX, which should simplify network administration.

Users with multivendor internetworks are advised to approach the network design and router configuration with caution. Sam Shuler, principal consultant for The Yankee Group in Dallas, has experience with the major internetworking vendors, including Advanced Computer Communications, Cisco, Ungermann-Bass, Inc. and others. "The problems we have encountered fall into two areas: interpretation and implementation of standards, and traffic management capabilities."

Shuler cites the implementation of the interrouter protocol OSPF as an example of these interpretive problems. "OSPF is more sophisticated than RIP and can be a complex protocol to use. The safest bet is to standardize on one vendor's product line. If this is not possible, build a model of the proposed internetwork, and thoroughly test it in a controlled lab environment before deploying it in the field."

BY MARK A. MILLER

PERFORMANCE COUNTS

Numbers of interfaces, buses or processors alone don't provide for a definitive measure of a router's performance; some hard numbers must back up the marketing hype. Much of the pioneering work in network device benchmarking has been spearheaded by Scott Bradner, a consultant with Harvard University's Office of Information Technology and chairman of the Internet Engineering Task Force's (IETF) Benchmarking Methodology Working Group.

The working group has produced an openly available Internet document, RFC 1242, titled "Benchmarking Terminology for Network Interconnection Devices," which defines many of the terms used to measure router performance. For example, filtering is defined as "the process of discarding received frames by administrative decision, where normal operation would be to forward them." Likewise, throughput is defined as "the maximum rate at which none of the offered frames are dropped by the device."

In gathering responses for the Buyer's Guide chart, *Network World* specified that the vendors use the RFC 1242 definitions for their throughput responses. We also specified fixed packet sizes, which were designed to better match real-world conditions, for the throughput to be measured against and asked that the measurement be made between two LAN interfaces, not the aggregate of all interfaces on the router.

For example, Ethernet-to-Ethernet forwarding was measured with packet sizes of 64 and 1,518 bytes. Under these conditions, the maximum throughput is 14,880 and 812 packet/sec, respectively. Vendors that reported benchmark testing results at or very close to this theoretical maximum include Alantec Corp., Compatible Systems Corp., Coral Network, Cray Communications, HP, Newport System Solutions, Inc., Penril Datability Networks, Inc., Proteon, RAD Network Devices, Inc., Retix and Wellfleet.

Similar comparisons may be made for token-ring and FDDI interfaces. On the token-ring side, the maximum rate is 7,246 packet/sec for 4M bit/sec token rings, and 28,985 packet/sec for 16M bit/sec token rings. The maximum FDDI forwarding rate is 164,473 packet/sec. Remember that as the router's throughput increases, its overall performance improves, as well. These benchmarks distill all of that vendor hype — such as architecture and number of processors — down to one number.

PROTOCOL SUPPORT

Hardware issues such as media LAN/WAN interfaces, buses or processors aren't the only issues that network managers must face when designing a router-based internetwork. Support for the network layer protocols, the foundation upon which the router operates, is also a key buying criterion (see related story, this page).

Routers depend on two types of network layer protocols for their operation. The first type could be called the packet transport protocol, which defines the internetwork addressing scheme, communicates the length of the packet and identifies the next highest layer within that packet. IP, IPX and ISO's Connectionless Network Protocol (CLNP) are three examples of a packet transport protocol listed in the Buyer's Guide chart. These protocols originate at the end-user workstation or host, and must be consistently supported at every router along the way. In other words, before a NetWare workstation using IPX can communicate with its server, all intermediate routers, plus that server, must support IPX.

The Buyer's Guide survey included eight typical transport protocols. IP and IPX were almost universally supported. OSI protocols were a different story, as only 3Com, Ascom Timeplex, Cray Communications, DEC, Madge Networks, Novell, Penril, Plexcom and Wellfleet indicated support for CLNP on their products.

Interrouter protocols are used to communicate routing table and link status information among routers in a net. Standards-based examples in this category would be RIP, OSPF and IS-IS. Vendor-proprietary interrouter protocols, such as Cisco's Interior Gateway Routing Protocol, also exist. As with the transport protocol, a consistent choice of the interrouter protocol makes administration that much easier.

In reviewing the Buyer's Guide chart, OSPF is a clear choice for most vendors, followed by RIP and IS-IS. This is not surprising: OSPF was designed to correct some of RIP's shortcomings, and support for OSI protocols has not been widespread.

In addition to protocols that are incorporated into LANs or internetworks, many network managers also have legacy networks such as SNA that they must account for in the internet.

SNA INTANGIBLES

The rise of client/server computing during the 1980s has challenged the bastion of corporate computing — IBM's SNA. But rather than force customers to make a choice of one solution over another, router vendors are serving up appetizing side dishes that support both environments.

At the heart of the matter is the inherent differences between client/server and SNA communication. Client/server is fundamentally peer-to-peer, connectionless communication, which assumes a distributed environment. In contrast, classical SNA is a hierarchical, connection-oriented system, which is heavily dependent upon terminal polls and host timeouts to maintain its ultra-reliability.

While the mixing of LAN and SNA traffic on the same backbone presents the technical challenges of incompatible protocols, it brings many synergies, such as the elimination of duplicate WAN links and the possibility of a cohesive network management scheme. Several techniques for this integration are possible. (For more information, refer to *Network World's* special four-part series on SNA/LAN integration, published in the Aug. 2, 9, 16 and 23 issues.)

The first three techniques available with today's routers incorporate SNA traffic inside another data stream. Known as Synchronous Data Link Control passthrough, a separate port on the router accepts the synchronous data, passing it over the WAN link to the other end. (SDLC is a data link layer protocol used

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with SNA environments.) A fixed portion of the WAN bandwidth is dedicated to the SNA traffic, with the balance allocated to LAN data. This technique requires the fewest SNA reconfigurations but does not always make the most effective use of the WAN bandwidth.

Another technique known as encapsulation, or tunneling, places the SNA traffic inside another protocol's packet, typically an IP packet. The encapsulated data is then sent into a TCP/IP-based internetwork and stripped of the additional TCP/IP packet overhead at the destination router. IBM has proposed a technique, known as Data Link Switching, to the IETF for encapsulating SNA traffic for transmission within TCP/IP-based internets. The resulting increase in packet overhead may degrade the router's throughput, unless the WAN link's bandwidth is increased to compensate. The advantage of encapsulation is its ease of use — no translation of the original data stream is required.

The third technique performs a conversion between SDLC and Logical Link Control 2 (LLC2) frames. The SDLC format is native to the SNA environment, and LLC2 is compatible with either token-ring or Ethernet LAN transmission. This conversion replaces the SNA packet headers with the LLC2 header, leaving the balance of the packet intact. In some cases, that frame may take a second journey and be encapsulated for transmission into another environment such as IP. The advantage of this technique is that the converted frame is now compatible with standard LAN internetworking environments. The disadvantage is the high processing cost required to do these translations.

A fourth — although rare — technique is encapsulating LAN data into SNA traffic, maintaining the end-to-end structure of the SNA backbone. Adacom Network Routers, Inc.'s L2-SR 3000 is one router supporting this technique. For a true-blue SNA shop, with just a few LANs to integrate, this solution may be the best. The effects of the bursty LAN traffic on the SNA connections would need to be considered as part of the design, however.

For many internetwork designers, the future is seen as IBM's Advanced Peer-to-Peer Networking (APPN), the rearchitected SNA that allows communication between end devices without the mainframe getting into the act. The issue boils down to patience; APPN is still not quite fully fleshed out. Complicating that question is the recent announcement by Cisco halting its development of its Advanced Peer-to-Peer Internetworking architecture, which was positioned as an open — and, presumably, less costly — alternative to the IBM solution (*NW*, Aug. 16, page 1). Cisco will now license the APPN source code from IBM, joining 3Com, Adacom Network Routers, Plexcom and Systems Strategies, which have announced APPN support.

Frank Leeds, principal of Seitel, Leeds and Associates, Inc., a Seattle systems integrator, distills the SNA integration issue down to dollars and cents. "Most capital equipment can be amortized in less than five years. Therefore, the real issue boils down to the cost of the WAN links. Customers with high line costs and just a moderate commitment to SNA will benefit from an integrated backbone. Those who are true-blue shops, and with less multiprotocol traffic, should probably wait for APPN."

SUPPORTING THE INVESTMENT

Router buyers will not want to miss out on a number of network management and optimization options that are available on today's products. These include data compression, bridging of nonroutable protocols (such as Local Area Transport and Network Basic I/O System), network management support using SNMP, and product support from the vendors in terms of bulletin board systems, help lines, and user groups. Experienced buyers will carefully consider the vendor support and maintenance contract options before signing up.

Users agree with the need for strong vendor support but for different reasons. Randy Cosby, network manager at Texas Children's Hospital in Houston, views vendor support as a crucial factor that influences router purchases. "Service and support are crucial elements in our purchase decisions. You can't find a better example of a true mission-critical application than a hospital."

For the most part, users are pleased with the product support they receive from vendors. Paul Franchois, computer specialist at the National Institute of Standards and Technology (NIST) in Boulder, Colo., notes the importance of competent product support. "I probably ask our vendors a question once or twice a month," Franchois says. "If a bug is suspected, I need to know that my concerns are getting to the software engineers that can resolve the issue in the next version of code and when that patch will be available."

Network managers with widely distributed internetworks may opt for an integrated network management scheme that allows them to provide much of the support themselves. Steven Laak, senior network planner at General Mills, Inc., headquartered in Minneapolis, helps manage a network consisting of more than 70 routers and 240 intelligent hubs, all supplied by HP. "Our network has grown from 2,000 attached devices to over 7,000 in the last 18 months. Without our SNMP management system to control, monitor and update our software, we would have had to double our network staff."

Laak and his associates use HP's OpenView network manager and its router management software to monitor and control their internetwork, which is spread among 50 locations. "Our distribution centers depend upon their LANs for the inventory and shipping systems," he says. "If that LAN fails, a packing list can't be printed and a truck full of Wheaties or Cheerios is then delayed. OpenView gives us both an early warning of potential problems, plus the ability to remotely configure the internetwork. Without these tools, our support costs would dramatically increase and our profitability would suffer."

The most popular option for remote router configuration and support is SNMP coupled with an SNMP-compliant network management console, such as SunConnect's SunNet Manager or NCR Corp.'s StarSentry. When a software upgrade is required, the ability to download it directly from the vendor into the router's memory can boost net availability.

In addition to multivendor SNMP management support, Laak also considered each vendor's proprietary management system during the product selection process. These proprietary schemes are typically accessed using a Telnet session across the internetwork. Laak benchmarked three network management functions: statistics displays, log tables and a quick configuration editor. Of these three, Laak found the quick configuration editor to be especially important, as it allows router configurations to be changed on the fly as dictated by new network conditions.

Many vendors supplement SNMP support with proprietary Management Information Base extensions, Telnet access to the router's proprietary network management system, or IBM NetView support. The key factor for network administrators is to focus on a network management strategy, such as NetView or SNMP, and then consider support for this management system to be a key factor in the router selection.

PALATABLE PRICES

After carefully selecting the interfaces and protocols, considering the architecture and performance, and looking into product support and management, your trip down the smorgasbord is complete. And the bill may surprise most users; today's routers provide an amazing price/performance, especially at the low-end of the market.

On the software-only side, the Apple Internet Router is priced at $499, while Novell's NetWare Multi Protocol Router, ranges from $995 to $1,495. Prices for PC-based products range from $790 for Niwot Network, Inc.'s PC Route Node to $9,599 for each of Microcom's offerings, with a number of products from Cayman, Hughes, IDEA and Gateway priced around $2,500. Performance and protocol support may vary widely in this area, so define your requirements carefully before shopping.

Proprietary router platforms tend to be marketed by a product family rather than a single product offering. Examples include 3Com, ACC, Andrew, Cisco, CrossComm, DEC, HP, Penril, Proteon, RAD, Retix and Wellfleet

Continued on page 58

Router selection process

It's not surprising that in a recent survey of 100 *Network World* readers, 98 respondents ranked service and support as the most important criteria in their router selection process. What is somewhat startling, however, is that users relegated performance — the former criterion cornerstone — to third place. What is the issue superseding performance in readers' minds? Conformance to standards.

Router selection criteria
Based on highest possible score of 10

Criterion	Importance rating
Service/support	8.91
Conformance to standards	8.81
Throughput/performance	8.44
Ability to route SNMP-based protocols and bridge nonroutable protocols	7.80
Ease of use	7.56
Support for wide-area services	7.41
Router upgrading to support internal Asynchronous Transfer Mode switching	7.13
Scalable process architecture	6.84
Price	6.32
SNA integration capabilities	5.87

SOURCE: FOCUS DATA INC., FRAMINGHAM, MASS.

The lack of Systems Network Architecture standards, incompatibility among vendors, no standards for network management and the lack of interoperability leave many shaking their head over what one user calls "the somewhat black art of configuring different vendors' routers."

"The bottom line is whether or not a router meets our requirements for wide-area networking," says one user, adding that support for multiple protocols is an overriding factor in a router's effectiveness on a WAN.

Echoing those sentiments, 86% of those survey respondents currently using routers run three or four protocols over their internetworks. Currently, the most widely used protocols are Transmission Control Protocol/Internet Protocol, NetWare Internetwork Packet Exchange/Sequenced Packet Exchange (IPX/SPX), DECnet, SNA and AppleTalk, respectively.

But SNA should outdistance DECnet over the next 12 months if survey respondents' multiprotocol intentions are realized.

The results of the survey are based on responses from 78 readers who currently have routers installed and 22 others who plan to purchase devices within a year. Thirty-seven percent of routers currently in use are being employed locally, while 63% are connected directly to a WAN.

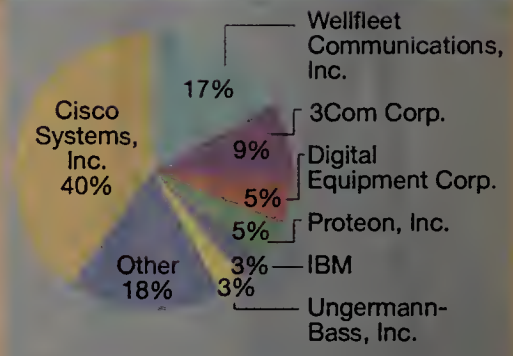
Virtually all readers emphatically stated that they choose routing products only from a small pool of leading vendors to ensure the highest levels of performance and service and support.

"I don't want someone who's just put their first router on the market," says one respondent.

"Routers are becoming critical pieces of equipment in our networks. I look at their installed base. They have to have a history in the industry and a great support record. They have to give us assistance when we need it. I would never select an unknown company. [I] only buy from the top tier."

The top vendor choices among readers are Cisco Systems, Inc., with a dominant 40% market share, followed by Wellfleet Communications, Inc., with a market share of 17%.

Router market leaders



Based on a survey of 78 readers.

SOURCE: FOCUS DATA, INC., FRAMINGHAM, MASS.

When asked about pricing, users indicated that $6,550 would be a fair price to pay on average for a local router. For a router with both local and remote capabilities, the average price users are willing to pay is $12,600.

BY BARBARA WIERZBICKI

Focus Data, Inc., a market research firm based in Framingham, Mass., gathers data from end users to determine network and information systems usage, needs and trends. For more information, call Mona Dabbon at (508) 626-2556.

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Letters

Continued from page 42

Schmall is, or how to reach him. Could you please send me his E-mail address? Has he written more on this subject?

John Stubblebine
Engineer
Hewlett-Packard Co.
Cupertino, Calif.

Editor's note: Schmall is the telecommunications director of an insurance holding company. Other articles he has written for Network World *include: "Seven management sins" (Oct. 5, 1992, page 31); and "Managers who foster trust foster efficiency" (July 24, 1989, page 21). He currently does not have an E-mail address, but you can reach him by phone at (502) 560-2446.*

Wring the Bells

Regarding your column "Break up the Baby Bells" (Aug. 9, page 45):

I agree with the author that the government should proceed with removing the monopolies of the Baby Bells as quickly as possible.

It's a myth that a monopoly was required in order to build up the telephone system in this country — a public relations myth partly generated by the Bell system once it had purchased most of the private telephone systems that were used to pioneer telephone service in this country.

We have the remarkable situation right now where an industry that can interconnect with satellites 22,000 miles out in space and easily call ships at sea almost instantaneously claims it has great difficulties interconnecting with another telephone company in the same city. These, of course, are opinions that are convenient for the monopolies and may come from them to preserve their situations.

If you had free competition in the local exchange, the local telephone companies would be eager to interconnect with one another — and perhaps even with companies outside the local telephone area — to offer more value to customers and, therefore, become more competitive.

I also believe that the quick deregulation of local telephone service can improve American exports. The reason is we will then pioneer some technologies that will sooner or later also be needed in other countries.

If this country proceeds with completely free competition in the local exchange, we will see new products and technologies emerge that will become very competitive.

Roald Steen
Correspondent
Telecom Revy, Norway
Woodbury, Minn.

Buyer's Guide

Continued from page 55

offering low-end, mid-range and high-end products.

As a general rule, price is proportional to the number of LAN and WAN interfaces as well as the protocols available on a particular product. High-speed interfaces, such as FDDI or ATM, or built-in redundant hardware can increase the cost to more than $100,000 for top-of-the-line models, so be prepared for sticker shock in some cases.

Also, routers that supply premium performance — approaching the theoretical limits of the technology — come with a premium price tag.

So what's on the horizon for routers? Increasing competition at the low end will widen the choices for remote office support. A wide availability of interfaces for emerging LAN and WAN services provides assurance against short-term product obsolescence.

And increasing power in the core architecture provides processing engines that will not give up with added network traffic.

In short, router vendors have served up a menu that will satisfy any internetworking appetite.

Contributing Editor Miller is president of DigiNet Corp., a Denver-based data communications engineering firm. His latest book, *Managing Internetworks with SNMP*, discusses SNMP and SNMPv2 from the perspective of the network analyst or manager. Miller may be reached via the Internet at mark@diginet.com.

Help desk

Continued from page 2

environment:

■ ***Segment the ring.*** *Break the larger ring into smaller pieces, and implement a higher capacity 16M bit/sec backbone to interconnect the 4M bit/sec segments if needed.*

■ ***In a multiring environment, keep users and servers on the same ring whenever possible.*** *This gives client workstations the most direct path available to target server. This should be done in conjunction with Recommendation 1.*

■ ***Replace standard token-ring interface cards in servers with the highest performance card available.*** *This will increase database performance by increasing overall server throughput. Exactly what increase will be seen depends on the choice of interface card, NOS, drivers, database in use and current server utilization.*

I am looking to make a career move from my current position of installing, maintaining and troubleshooting my company's local-area network and personal computer software. What advice can you give me regarding the types of jobs I might be qualified for, which types of companies to consider, salary information and how to go about the job search?

Cynthia Virgion,
West Springfield, Mass.

Frank Schoff, president of Management Recruiters, a search and recruiting specialist in Cedar Mountain, N.C., replies:

Your programming skills, combined with a working knowledge of PCs and LANs, make you an attractive candidate for a PC/LAN support position in a distributed computing environment. Typically, these positions are part of a help desk function. Once established in such a position, you can expand your knowledge of both PC and LAN technologies and elect to go in either direction as a specialty.

In deciding which companies to consider, I suggest you choose a company that is large enough to have multiple positions and multiple levels with the PC/LAN support area, and that is making a major commitment to LANs and PCs.

The majority of degreed, nonmanagement technology professionals fall within the $40,000 to $60,000 range. However, I think repositioning for career growth is sometimes more important than salary; therefore, you might want to consider positions in the $30,000 to $40,000 range.

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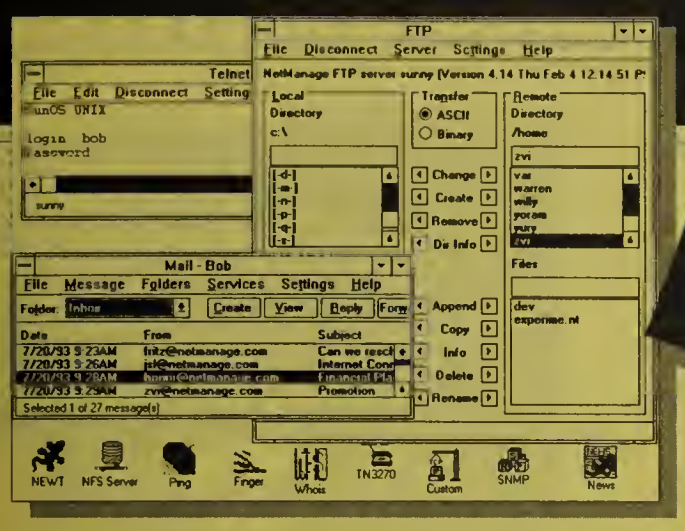

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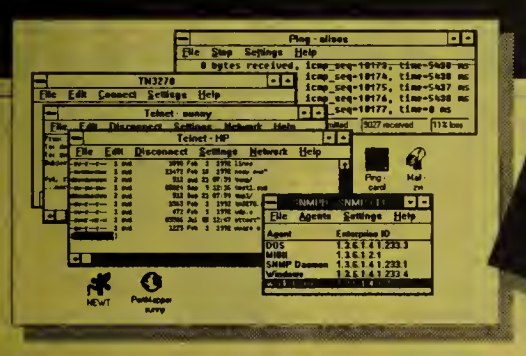

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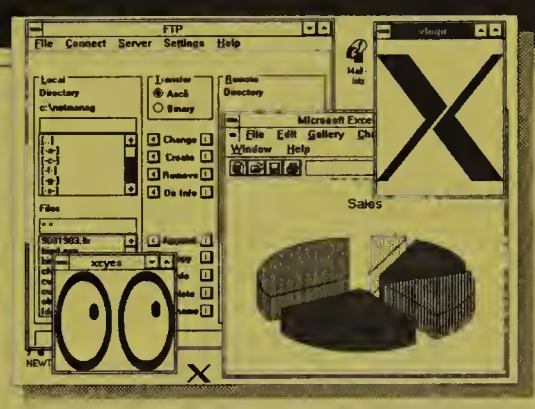

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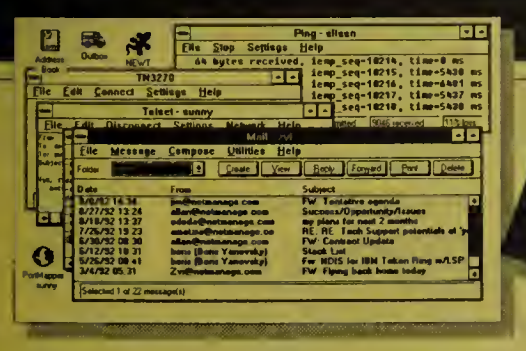

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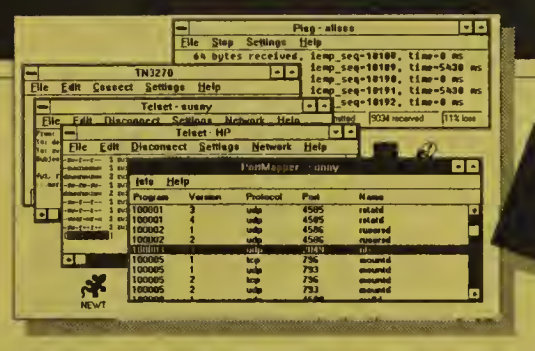

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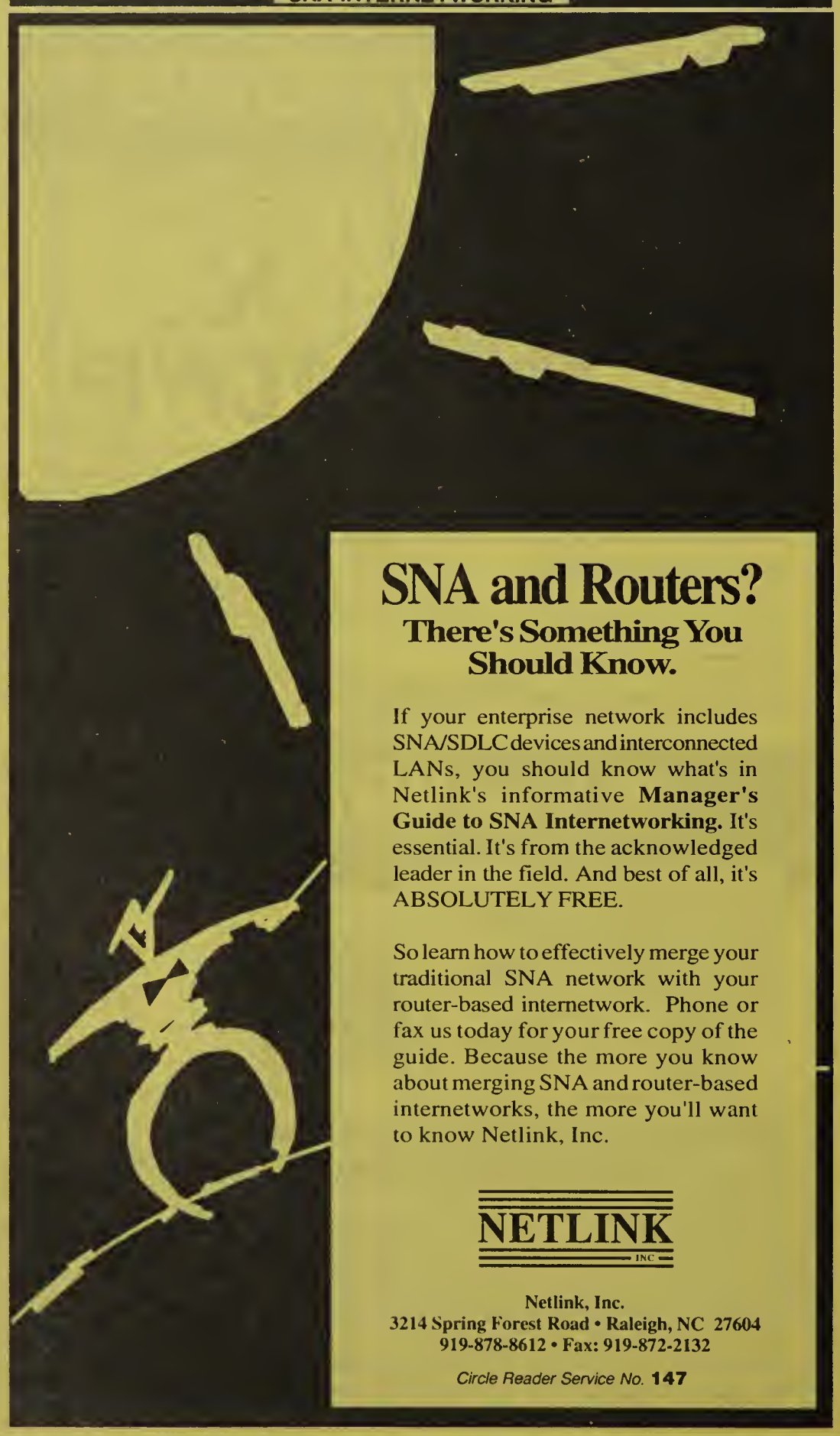

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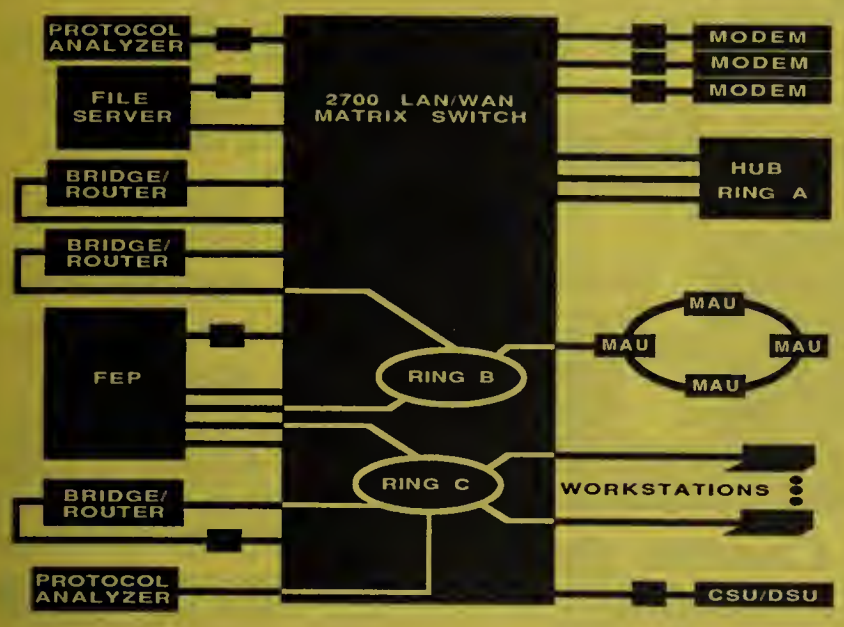

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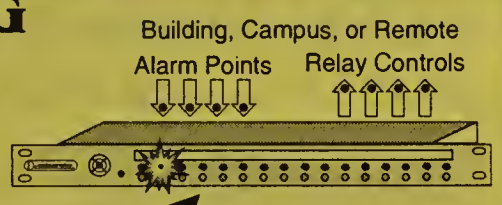

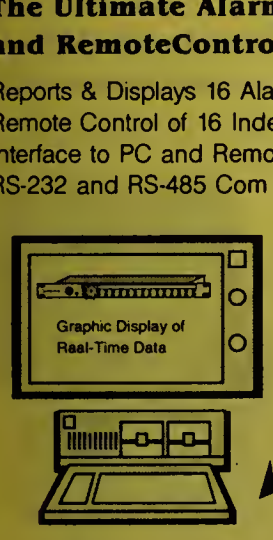

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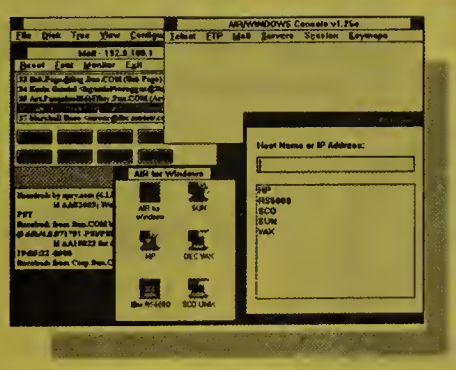

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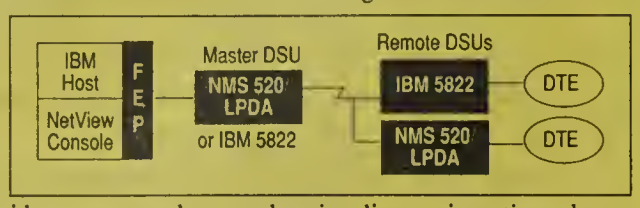

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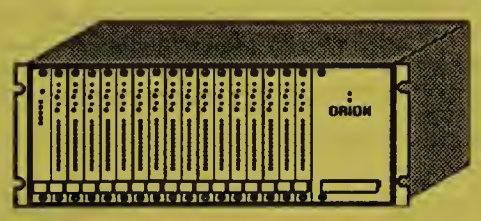

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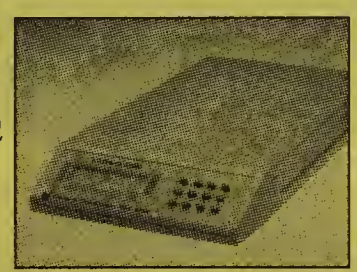

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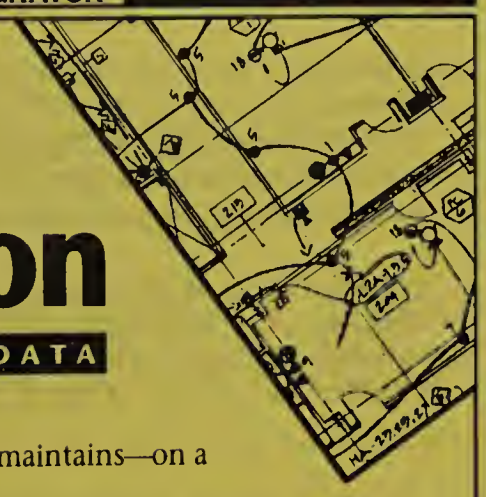

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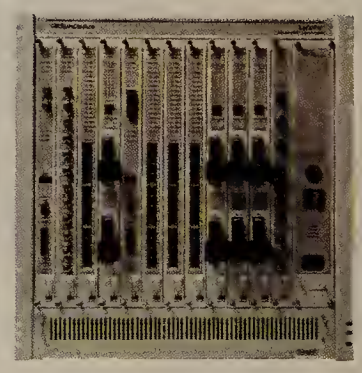

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Unix plan

Continued from page 1

This means companies such as Hewlett-Packard Co., IBM, The Santa Cruz Operation, Inc. (SCO) and Sun Microsystems, Inc. will have to either accept these additional NetWare features in their Unix implementations or spend time and resources removing them.

Most vendors said they will not change their source code simply because Novell has decided to step in and take over the Unix market and, despite the promise of application portability, will not back Novell's efforts.

"I think Novell was mistaken when they assumed because they have a 75% market share in the LAN space, it automatically implies that if they said something about Unix, everybody would think that it's so important," said Scott McGregor, senior vice president of products, at SCO, which holds about 25% of the Unix operating system market with its SCO for Unix product.

SCO is one of the vendors that gets its Unix kernel from USL.

Mary Hubley, an analyst with Datapro Information Servers Group in Delran, N.J., said none of the other major Unix vendors such as HP, IBM and Sun are likely to accept Novell's proposed UnixWare standard with open arms.

However, she added that while UnixWare, as a standard, may solve interoperability problems, it is not the only solution.

Three weeks ago, 75 Unix vendors, including HP, IBM, SCO and Sun, unveiled a common application program interface (API) that will allow users to easily port applications to different versions of Unix. "That development makes Novell's announcement not as important as it would have been without that API initiative," Hubley said.

STEVE BOORNS

NOORDA

NETWARE/UNIXWARE TIE

Although the announcement was thin on other specifics, the company did map a broad integration plan for NetWare and UnixWare, essentially a vision of NetWare serving as a net services platform and UnixWare as an application platform.

"What we're starting here is the confluence of NetWare and Unix," said Ray Noorda, Novell's president, chairman and chief executive officer. "We think it is a naturally matched pair because Unix supplies the vertical application services, while NetWare supplies the horizontal network services."

To achieve this, Novell will integrate by mid-1994 NetWare services into UnixWare. This will provide for common management, common global directory services and a common development environment.

The goal is to allow users to be able to simply drop a UnixWare-based application server onto a NetWare local-area network and have the two interoperate seamlessly without requiring the user to know what resources are on which server. Today, UnixWare and NetWare only share common file service capabilities — integration is not seamless.

GOOD WORK

Most observers had nothing but praise for Novell on both fronts.

"Something like this is sorely needed to make Unix more powerful in the PC world," said Stuart Beckett, director of technical services at Burkey & Associates, Inc., a system integrator and NetWare user based in Columbus, Ohio. "One reason some people have stayed away from Unix is because it comes in so many flavors. With this, Unix will be Unix, no matter who you buy it from."

The second reason is fear. "Unix has a big intimidation factor. It kind of scares you," said John Probst, a senior programmer at Lowery, Inc., a NetWare user based in Park City, Utah, that has not implemented Unix. Yet Probst added that the company needs a higher end platform on which to run its databases.

A version of Unix that would seamlessly integrate into the company's existing NetWare environment could "have dramatic ramifications for us," Probst said. "We feel comfortable in our native NetWare world. If I can feel just as comfortable with a move to Unix, that would be phenomenal. Dang, I'd like that."

Pitch

Continued from page 1

of multimedia applications would be a godsend. We have a high interest in video, and this sounds like it could help a lot. All I want to know is, when can we get it?"

100VG-AnyLAN is being positioned as a desktop technology for high-performance work groups and a complementary feeder technology for shuttling LAN data to Asynchronous Transfer Mode (ATM) nets.

SIMPLE MIGRATION

"Our goal is to make migration to 100M bit/sec speeds a simple and low-risk proposition for both Ethernet and token-ring users," said Max Brownstein, marketing and strategic planning manager for IBM. "Because the technology requires no changes to the existing cabling infrastructure or network software, it's a cost-effective move, as well."

To upgrade, users would have to swap out desktop adapter cards and purchase a new hub or add 100VG-AnyLAN software to an existing hub. Upgrading to Fiber Distributed Data Interface — a rival 100M bit/sec LAN — would require not only changes to the network operating system and applications, but also new adapters and hubs, which would generally weigh in at more than the predicted prices for 100VG-AnyLAN components.

100VG-AnyLAN, which will run over shielded and unshielded twisted-pair wiring as well as fiber, is based on the same fundamentals as 100Base-VG, including Demand Priority frame switching and Quartet coding.

Using Demand Priority, an end node wishing to transmit a packet signals its request to the hub, and, if the network is idle, the hub allows transmission. When a packet arrives at the hub, the destination address is decoded and the packet is automatically switched to its destination.

If the net is not idle, the hub "latches" the request, meaning traffic is held until the end node receives an acknowledgement from the hub, which processes requests in the order received.

Quartet coding splits the data into four parallel streams of 25M bit/sec each, with one stream directed down each pair of a four-pair twisted-pair cable.

According to Brice, a draft standard for 100VG-AnyLAN is expected to be completed sometime in the first half of 1994. Users can also expect to see the first HP and IBM products rolled out in roughly the same time frame.

Those products will initially include hubs and workstation adapter cards, with router and switch interfaces to follow soon after. Pricing will generally be one and a half to two times that of standard Ethernet products.

The 100VG-AnyLAN products will come in either Ethernet or token-ring versions, allowing users to create token-ring and Ethernet LANs running at 100M bit/sec. Those nets can connect to their standard-speed counterparts through a speed-matching bridge running as software in a 100VG-AnyLAN hub.

HP and IBM said work is under way to develop a method where both packet types could be handled simultaneously by the same device.

Since 100VG-AnyLAN products will support the Simple Network Management Protocol, existing management platforms can be used to control these 100M bit/sec environments.

"Our goal is to make migration to 100M bit/sec speeds a simple and low-risk proposition for both Ethernet and token-ring users," said Brownstein.

VENDOR IMPACT

The announcement may have an immediate impact on a group of vendors — led by 3Com Corp. and SynOptics Communications, Inc. — that is pushing an alternative 100M bit/sec Ethernet standard, dubbed 100Base-X, which its proponents claim is "true" Ethernet because it keeps the media access control (MAC) intact.

Ironically, that decision to protect the MAC layer may prevent the 100Base-X group from offering similar capabilities for token ring.

"This announcement changes the equation for the two 100M bit/sec Ethernet parties because IBM is joining the 100Base-VG crowd, and the fact that you can run token ring over it opens up another whole market," said Michael Howard, president of Infonetics Research, Inc., a consultancy in San Jose, Calif. "IBM has been searching for a suitable multimedia LAN transport for a long time, and this technology fits that need. So it will definitely interest a large chunk of users."

Senior Editor Michael Cooney contributed to this story.

Carriers

Continued from page 7

marketing.

MCI did its bit last week to help the service along by adding help desk support, cutting capital costs through lease arrangements and broadening international connectivity, he said.

SPRINT

Sprint kept pace with MCI at the show with a series of changes to its switched 64K bit/sec service, scheduled for implementation Oct. 1.

Beginning next month, Sprint will double nationwide coverage for the service with access in more than 100 metropolitan areas. That expanded access anticipates a spurt in demand for switched data service that Sprint predicts will carry the market from $70 million this year to $1.3 billion in 1997.

In addition to wider domestic access, Sprint will also stretch its switched data services internationally to cover Canada, Japan, the Netherlands and the U.K. The carrier expects to be connected to 20 countries by the end of next year.

Sprint also announced a series of internal changes to its switched data service (*NW*, Sept. 20, page 1). To boost network performance, Sprint is jiggering its network architecture to handle the anticipated increase in call volumes. In Atlanta, the carrier is launching a service center that can individually test each segment of an Nx64K bit/sec link.

To reach smaller companies, Sprint is adding the switched data service to its Clarity product line for small and midsize businesses, allowing users to pool data and voice traffic for volume discounts.

Sprint believes that increasing demand for switched data service will be driven by a combination of factors.

For now, switched data applications for the most part remain limited to videoconferencing, according to Bernie Schneider, director of product management for Sprint's data services.

But the carrier is expecting demand for the service to increasingly come from users with file-transfer and local-area network connectivity applications. During the past month, such applications as imaging have accounted for half of the carrier's requests for service, Schneider said.

MCI last week also announced its entry into the transaction processing business, marrying its X.25 network with 800 access to provide businesses nationwide with point-of-sale and other services. The carrier joins Sprint and other providers that are well established in transaction processing.

ResponseNet will offer a response time of 10 seconds for access via 800 service, a figure that is competitive with other carriers' services, according to Weichselbaum. And access via its 800 network will enable MCI to reroute around failed links. The network is also capable of handling some transaction processing tasks, freeing up the host system and cutting down on transmission expenses, he said.

One of the premiere customers for MCI's new service is First Data Resources, Inc., a business unit of First Data Corp. that provides information processing and related services to credit card companies and other businesses.

First Data will be linking its host processors in Omaha, Neb., to the MCI network via switched 56K bit/sec lines.

The company plans to test the service in the fourth quarter, then begin migrating to the MCI network with the new year.

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T-1 access

Continued from page 1

multiple voice-grade private lines for access to SDN. We may be able to justify a T-1 at that location."

Vertical Systems Group, a consulting and research firm in Dedham, Mass., estimates that more than 3,000 U.S. companies have over one T-1 access line.

"This announcement may prompt competitors to follow suit," said Rick Malone, a principal with Vertical Systems.

Vaidya pointed out that users can further increase their savings by signing a long-term contract for T-1 access. Under AT&T's Access Value Plan, users that sign one- to five-year deals can save as much as 24% on dedicated access (*NW*, May 10, page 5).

AT&T will act as a single point of contact for users that want the carrier to coordinate access acquisition, and install, monitor and manage the dedicated access links.

"We think a full-service offering will prove attractive," Vaidya said.

The AT&T filing did include a request for an increase. The carrier wants to raise from $220 to $235 the monthly access connection charge that it assesses users.

Analysts said the cuts put local carriers between a rock and a hard place.

"The local carriers have to sell bulk access to AT&T because alternative access providers will do it if the local carriers don't," said Daniel Briere, president of TeleChoice, Inc., a Montclair, N.J., consultancy. "The user is the ultimate winner."

FCC

Continued from page 1

gional areas, which are subdivided into 492 metropolitan areas.

It also decided to let current cellular providers bid for spectrum in their own markets, but only for the 10-MHz blocks in the 2130 MHz-to-2150 MHz and 2180 MHz-to-2200 MHz ranges.

How the spectrum auctions will be conducted is to be decided at a future date, but the FCC's plan leaves the potential for seven service providers per area. Sources at the FCC said a single nationwide system may still emerge from the auction process since the FCC is considering auctioning large regional blocks under a single offering.

MCI Communications Corp. said it was disappointed that the FCC did not allocate national licenses but said it will still pursue plans to build a national consortium for PCS.

The commission also allocated 40 MHz of spectrum between 1890 MHz and 1930 MHz for "Unlicensed PCS," the portion of the spectrum where users will be able to operate voice and data equipment on an unlicensed basis without charge.

Following recommendations from the Wireless Information Networks Forum — a group of voice and data equipment manufacturers working on PCS technical issues — the FCC set up separate bands for "bursty" data applications and largely isochronous voice.

The FCC's decision to allocate more than 160 MHz of total spectrum to PCS — more than three times the 50-MHz chunk used by cellular services today — represents tremendous confidence in the new technology.

Although the FCC set aside 20 MHz more than originally planned for Unlicensed PCS — something Apple Computer, Inc. and others had pushed for — the FCC's decision nevertheless is a mixed blessing.

Microwave users now in the 2-GHz bands will be paid to exit the bands due to potential interference problems with PCS.

Although the spectrum originally planned for Unlicensed PCS (the 1910 MHz to 1930 MHz band) has the lowest number of microwave links (about 400), the new bands for exclusive data use (1900 MHz to 1930 MHz) have tripled that number.

It is estimated it will cost about $125,000 per microwave link to move microwave users from the 2-GHz range.

Jim Berger, Apple's director in government relations, said clearing out the microwave users will be difficult and take a lot of time.

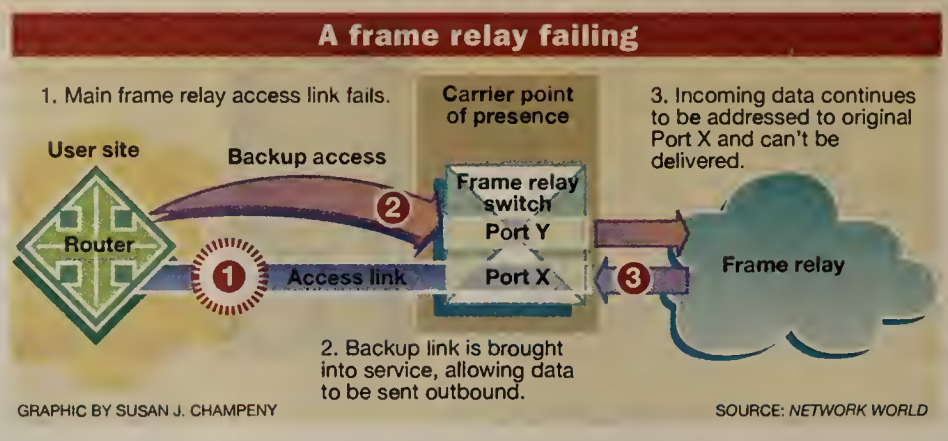
He pointed out that nomadic devices cannot be sold until the bands are fully cleared or else interference with microwave might result.

Apple, arguing that there would be enough spectrum for both unlicensed PCS and microwave users if a frequency "retuning" of microwave stations took place, had hoped the FCC would investigate this possibility so microwave users could stay.

The question of exactly how the microwave users will be paid was tentatively answered last week. The FCC said that PCS equipment manufacturers must join an industry group called the Unlicensed PCS Committee for Microwave Transition and Management (UTAM) — now chaired by AT&T — which will plot a course for clearing spectrum and paying microwave users. But the commission said it wants to see UTAM's formal plan before the decision is final.

WHAT IS PCS?

Personal communications service is a phrase coined by former FCC Chairman Alfred Sikes to describe emerging wireless services, which will eventually include everything from simple voice/data offerings to wireless LANs. PCS is based on cellular technology but uses small cells, which means portable devices can be low-powered and lightweight.



Frame relay

Continued from page 1

Fay said frame relay switch vendors should offer what he calls dual porting, or two ports that can use the same address. "If one link was lost, we could dial up the second port or establish a switched link," Fay said. "Users like ourselves who are using frame relay to support mission-critical applications want this dealt with ASAP."

StrataCom, Inc., whose switches are used by AT&T, WilTel, CompuServe, Inc. and others to provide frame relay services, acknowledged the problem.

Bryan Long, product-line director of private networking for StrataCom, said the solution Fay seeks is feasible and could be accomplished by adding a second port to each switch card. But he would not say if StrataCom will develop such a product. "We need to further investigate this to make sure that it's something [users] want."

Carriers have also recognized the problem, but none of them have come up with a solution that doesn't mean added expense for the user.

"We're aware of the problem and are trying to find an affordable solution for our customers," said Kevin Brand, a district manager of frame relay product management for AT&T.

WilTel and MCI Communications Corp. have each come up with a way around the problem, although both come at a price.

WilTel installs two-port A/B switches, each supporting two leased lines, at the user site and in its own point of presence (POP). If the primary leased access line is knocked out, the A/B switch diverts traffic to the backup link.

The backup link is connected to a companion A/B switch at the WilTel POP, which, in turn, is connected to a single port on WilTel's frame relay switch. So no matter whether the primary or backup link is in use, data winds up at the same port, which eliminates the addressing problem.

MCI has a similar approach, but it allows the use of a switched link for backup, said Ray Kang, a senior product manager with MCI.

In the WilTel case, users would have to shell out for a second leased line plus the A/B switches. MCI's plan would presumably be less expensive because it calls for switched backup. However, Kang would not quantify the cost, saying only that it is priced on an individual basis.

Other options offer varying levels of expense and function. Tom Martin, director of computer services for Lithonia Lighting, an electric company in Conyers, Ga., installed two T-1s, each supporting a Cisco Systems, Inc. bridge/router, to support frame relay access to MCI. The two dedicated links leave through separate building exits and connect to separate MCI POPs. One T-1 supports a 512K bit/sec access link and voice channels, while the other T-1 remains dormant.

Lithonia Lighting's remote sites have access links ranging from 64K to 128K bit/sec and use switched 56K bit/sec service for backup. But this does not entirely solve the problem because the backup link is connected to a different frame relay switch port, which means data can get out, but it cannot get in.

Another option is dial-up links that bypass the frame relay net entirely.

"It makes much more sense to use dial-up links between the sites that need to communicate, rather than wait while the local carrier works on the problem," said Reuben Lantto, director of international telecommunications for Cargill, Inc. in Minneapolis. "The bottom line is you have to recover, and recover fast."

But that solution gives users only point-to-point links between sites, as opposed to the mesh networking that a single frame relay access link provides, and it requires a device capable of providing switched backup. Analysts say all this leaves users with some tough decisions.

"Each frame relay user needs to take a hard look at the applications they have riding on frame relay and perform a risk analysis," said Tom Nolle, president of CIMI Corp., a Voorhees, N.J., consulting and research firm that tracks data network services. "Some users may have a hard time justifying backup."

One case in point is Byers California, a longtime frame relay user that has considered linking some company sites to multiple POPs but cannot afford to leave a dedicated backup link largely unused.

"I'd love to see carriers offer what I call lights-out links, which are discounted lines that you can use for backup," said Mike Higgins, MIS technical support manager for Byer, a clothing retailer based in San Francisco. "If you're not going to be using the line on a regular basis, there's no reason why carriers couldn't come up with an attractive arrangement."

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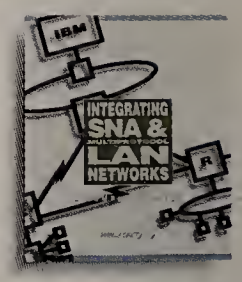

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